3: AFFECTED ENVIRONMENT

3.1 Introduction

This section of the EA/IS provides a description of existing environmental conditions and applicable regulations within the area of proposed geothermal exploration activities and the surrounding vicinity. The descriptions, by environmental parameter, are based on site surveys, consultations with agency personnel, and information provided in the following documents:

- Plan of Operation-Exploration for Calpine Corporation and CPN Telephone Flat, Inc. in the Glass Mountain Geothermal Resource Area Glass Mountain Unit 2002-2003 Exploration Program (CPN Telephone Flat 2002).
- Fourmile Hill Geothermal Development Project Final EIS/EIR (BLM et al 1998)
- Telephone Flat Geothermal Development Project Final EIS/EIR (BLM et al 1999; This EIR was not certified and the Federal Agencies chose the No Action Alternative)
- Glass Mountain Unit Geothermal Exploration Project EA/IS (BLM et al 1995)
- Fourmile Hill Area Geothermal Exploration Project EA/IS (BLM et al 1995a)
- Klamath National Forest Land and Resource Management Plan (USFS 1995)
- Modoc National Forest Land and Resource Management Plan (USFS 1991)

3.2 Geology and Soils

REGIONAL SETTING

The Project area is located east of the Cascade Mountain range province and west of the Basin and Range province. The Cascade Mountain range is composed principally of rhyolitic to basaltic volcanoes. Volcanoes within the Cascade Mountain range include stratovolcanoes (e.g., Mount Shasta), small cinder cones (e.g., Fourmile Hill), glass flows (e.g., Glass Mountain), and shield volcanoes (e.g., Medicine Lake Volcano). Lassen Peak and Mount Saint Helens are two (2) of the recently active volcanoes in the range (BLM et al. 1998).

The Project area is located in an area identified as the Medicine Lake Highlands, which is located approximately 30 miles (50 kilometers) northeast of Mount Shasta. The Medicine Lake Highlands is composed primarily of volcanic formations, including cinder cones, caldera basins, craters, lava flows and domes, and a basalt capped plateau (BLM et al 1995).

The Medicine Lake Highlands originally formed as the Medicine Lake volcano, which was a shield volcano measuring approximately 20 miles (32 kilometers) across and approximately 2,500 feet (762 meters) high above the surrounding lands (BLM 1995). The volcanic shield collapsed approximately 500 feet (152 meters) early in the history of the volcano (Dzurisin, et al. 1991). The resulting basin measures approximately 6 miles (12 kilometers) long by 4 miles (7 kilometers) wide (BLM et.al1995; Donnelly-Nolan 1990).

After the collapse of the caldera, numerous volcanic eruptions resulted in the formation of several individual rim volcanoes, which hide the former caldera boundaries (California Division of Mines and Geology 1966). Recent volcanic activity in the Medicine Lake Highlands has included the eruption of basalt flows, obsidian flows and domes, and pyroclastic pumice (BLM et al 1995).

Soils

Soils in the Project area are mainly derived from the basalt, andesite tuff, pyroclastic pumice, cinders and ash of various geologic ages from these volcanic sources (USFS et al. 1983). Soils in the Project vicinity were formed by weathering and the mechanical breakdown of extruded volcanic rocks. The soils show relatively high forest productivity with moderate to low potential for erosion (USFS et al. 1983).

The primary soil types at the Four mile Hill well sites (64-27 and 85-33) include Belzar-Wintoner, Inville-Wintoner, and Redcap-Stonewell. Soils in the Klamath National Forest have been classified by the rate at which water infiltrates soil from the surface (USFS 1982). Descriptions of these major soil types are provided in Table 3.2-1 of the 1998 Fourmile Hill Geothermal Development Project EIS/EIR.

The primary soil types at the Telephone Flat well sites (68-8, 31-17, and 87-13) are the Divers-Lapine-Kinzel, Kinzel-Lapine-Divers, Lapine-Wuksi-Divers, and Stonewall-Yallani families. Detailed information for these soil types can be found in the soil survey for the Modoc National Forest Area (USFS et al. 1983). Soils in the Modoc National Forest have been classified according to the water runoff potential, the erosion hazard, and erosion

factor (USFS et al. 1983). Descriptions of these major soil types are provided in Table 3.1.1 of the 1999 Telephone Flat EIS/EIR.

Minerals

The only mineral resources known to exist in the vicinity of the Project area, other than the geothermal resources (see below), are a number of small rock quarries used by the USFS as a source of road-building materials and several existing and former pumice mine operations located north of Glass Mountain (BLM et al 1995).

Unique Geologic Features

The USFS recognizes areas with unique characteristics as Special Interest Areas (SIAs), which are to be protected for recreational, scientific, cultural, or educational use. Each formally designated SIA is managed with its own set of guidelines and standards. The following SIAs have been established in the vicinity of the Project area on the basis of their unique geologic features.

- Pumice Craters Geologic Area
- Little Glass Mountain Geologic Area
- Fourmile Hill Tree Molds Geologic Area
- Medicine Lake Glass Flow Geologic Area
- Glass Mountain Glass Flow Geologic Area
- Burnt Lava Flow Geologic Area

None of the project well sites are located at any of the forest special interest areas. The Medicine Lake Glass Flow, Glass Mountain Glass Flow, Fourmile Hill Tree Molds, and Pumice Craters Geologic Areas are described in detail in Section 3.2 of the 1998 Fourmile Hill Geothermal Development EIS/EIR. The Medicine Lake Glass Flow, Glass Mountain Glass Flow, Little Glass Mountain, and Burnt Lava Flow Geologic Areas are described in detail in Section 3.1 of 1999 Telephone Flat EIS/EIR. All six of the SIAs are shown in Figure 3.1-1.

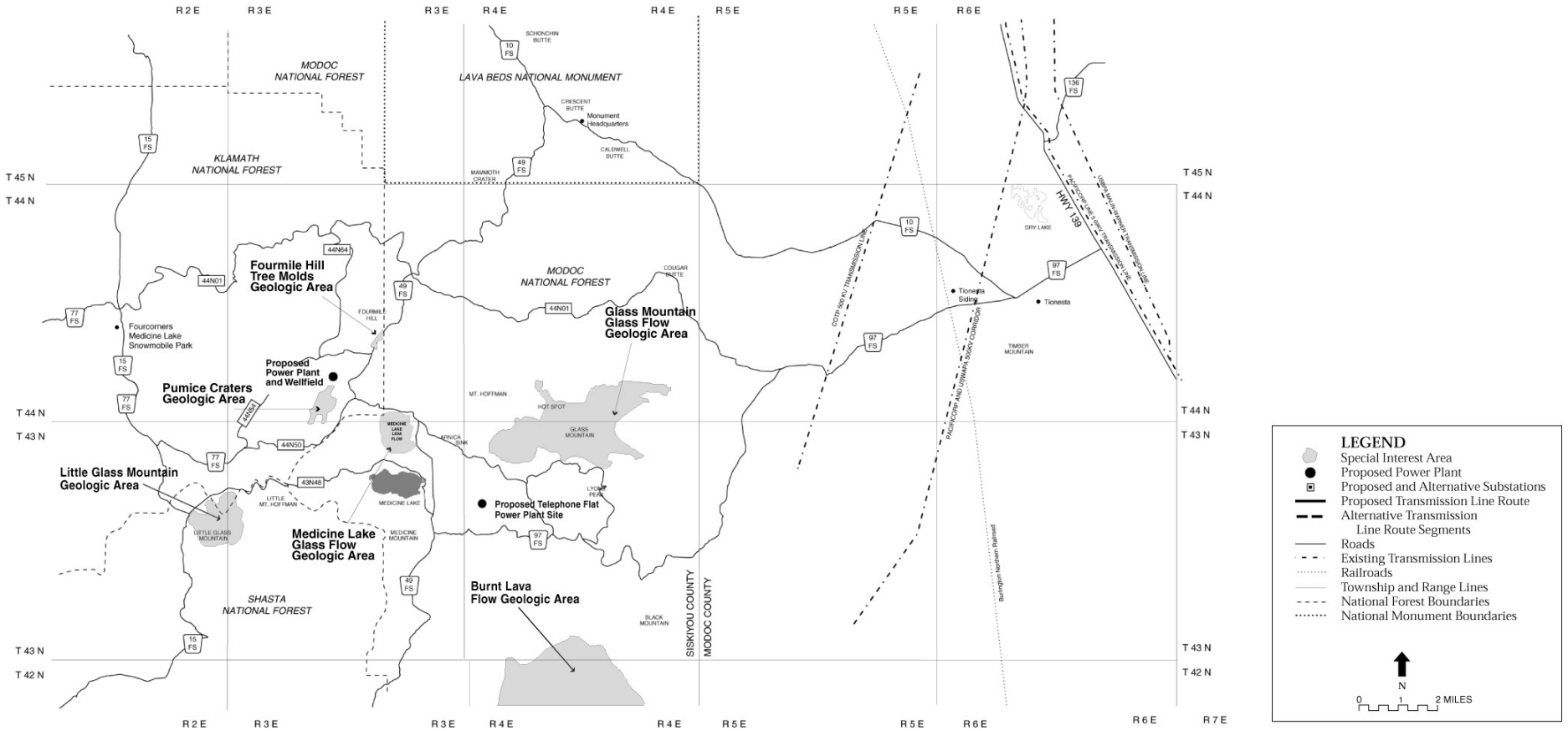
GEOTHERMAL RESOURCES

A geothermal resource can be defined as a geologic accumulation of thermal energy potentially exploitable for human purposes (Anderson et al. 1998). Conditions at Glass Mountain favor the development of high-temperature hydrothermal systems. In order for a geothermal resource to be a viable energy source, the following are required:

- Concentration of heat energy relatively shallow in the earth's crust
- Steam or hot water to bring the heat to economically drillable depths
- A permeable subsurface geothermal reservoir
- A lithologic and/or hydrothermal alteration cap above the reservoir.

The geothermal resource at Glass Mountain is described in detail in the hydrology section (Section 3.3) of this document.

Figure 3.2-1: Geologic Special Interest Areas in the Project Vicinity



SOURCE: BLM et al 1998 and BLM et al 1999.

GEOLOGIC HAZARDS

Seismicity

Fault activity associated with Cascade volcanoes and the Modoc Plateau has the potential to produce surface rupture and ground shaking. The Project area does not have historically high seismic activity. Sporadic seismic activity has been recorded in the region, of which the most notable was in late 1988, when the Medicine Lake Basin area experienced a swarm of small earthquakes. Most of the activity has been microearthquakes (i.e., less than magnitude 3.0) (Dzurisin et al. 1991).

There are two active faults located within close proximity of the proposed Project which could produce a seismic event of a magnitude 5.0 or greater on the Richter scale; the Gillem-Big Crack Gillem) Fault and the Hat Creek-McArthur-Mayfield Fault (Wills 2002). The southern endpoint of the Gillem Fault is located approximately 5 miles north of the well sites 64-27 and 85-33. The northern endpoint of the Mayfield fault is located approximately 4 miles south of the Telephone Flat well sites. Both faults are normal faults and are capable of producing a maximum potential earthquake of 6.6 for Gillem and 7 for Mayfield (Department of Conservation 2002). Other local faults are described in more detail in the geology section and Figure 3.2-3 of the 1999 Telephone Flat EIS/EIR.

Active faults present two basic hazards to people and structures: ground shaking and surface rupture. Ground shaking occurs when there is sudden movement along a deep portion of a fault. Surface rupture occurs along a fault or fault zone and is characterized by fault motion, which may be sudden or occur as a slow creep.

Microearthquakes can be triggered by both the production and injection of geothermal fluids, which can change the natural stresses and/or rock strength under some geologic conditions. Withdrawal of geothermal fluid can induce brittle failure as pore pressures decline. Fluid injection can cause increased seismicity in a number of ways. When injected fluid locally exceeds ambient fluid pressure, the increase in pore pressure can cause a decrease of effective normal stress across fractures. Injected fluid may also cool rock adjacent to fractures, which reduces the normal stress across them. The mass loading of the injected fluid may increase vertical stress and the shear stress across dipping fractures in underlying rocks (Greensfelder et al 1993).

Liquefaction

Liquefaction occurs when saturated, cohesionless materials (usually sand or silty sand) are transformed from a solid to a near liquid state due to the increase in pore-water pressure that can be caused by moderate to severe seismic ground shaking. Three types of liquefaction may occur: flow landslides, laterally spreading landslides, and quick condition failure may occur (Keller 1982). The soils in the region are coarse, well drained, rarely saturated, and not considered to be susceptible to liquefaction. Liquefaction is not known to have occurred in the Telephone Flat Project wellfield area. In general, the soils in the Fourmile Hill Project area are not susceptible to liquefaction during a seismic event (BLM et. al 1998).

Volcanism

The Medicine Lake Highlands has had at least three volcanic eruptions in the last 1,500 years, and the area has been identified by the USGS as one of the four most probable sites

in California where a volcanic eruption may occur (USFS 1991). However the youngest known eruption occurred approximately 900 years ago, and there are no signs of imminent renewal of volcanic activity.

An eruption in the Medicine Lake Highlands area would most likely be similar to previous eruptions and be fairly non-catastrophic. An eruption would be accompanied by a release of gas and deposits of ash, pumice, and cinders (USFS 1991). Surface flows of hot molten lava and mud would not be expected to be extensive. However, silicic eruptions may end with the eruption of dacite to rhyolite flows or domes that could reach several miles from their vents. Additional clastic volcanic materials could fall several hundred miles downwind (Hoblitt 1987).

Subsidence

Subsidence is the settling of the ground surface due to the compaction of underlying unconsolidated sediments. Subsidence is most common in uncompacted soil, thick unconsolidated alluvial material due to groundwater, or oil withdrawal, and improperly constructed (poorly compacted) artificial fill. General subsidence in the area related to the regional volcanic geology has been documented (Dzurisin et al. 1991), with a maximum measured rate of approximately 1 cm per year.

Slope Stability/Landslides

Landslide and other earthflow deposits are rare in the Project area. The Project area also has a low risk of slope movement due to the gentle slopes, stable parent material (volcanic bedrock), and a large percentage of cohesive soils. A landslide is defined as the rapid movement under the influence of gravity of a mass of rock, earth, or artificial fill on a slope. Because of the low risk for landslides in the Project area, however, little monitoring is done (USFS 1991).

REGULATORY SETTING

Federal

U.S. Forest Service. The USFS has not yet developed a geologic resource inventory of potential seismic hazard areas. The USFS recommends constructing permanent facilities away from active fault traces to minimize hazards associated with seismic activity. When planning a project, the USFS recommends (USFS 1991):

- Establishing the proximity of the site to known faults and epicenters.
- Reviewing geologic conditions at or near the site that might indicate recent fault or seismic activity.
- After accumulating all data, determine potential hazards relative to the intended land use or development.

The USFS does not have a formalized multi-agency emergency response plan associated with a volcanic eruption in the Medicine Lake Highlands. In the event of an eruption, the U.S. Geological Survey (USGS) would be the lead agency, establishing all potential hazard zones, and the USFS would provide support to the USGS (USFS 1991).

For areas of high risk for landslides, the USFS requires a site-specific inventory to be completed during the Project planning phase. The inventory should accurately delineate

potential areas of mass wasting and identify means to reduce potential impacts (USFS 1991).

Klamath and Modoc National Forest Land and Resource Management Plans. The Klamath and Modoc Land and Resource Management Plans (LRMPs) contain forest wide and focused standards and guidelines according to each resource area. The introduction of this document (Section 1.0) describes both the Klamath and Modoc LRMPs. Every proposed project must comply with USFS direction from the resource management plans.

Bureau of Land Management (BLM). The BLM is responsible for authorizing geothermal fluid production and injection operations on federal geothermal leases. Geothermal operations regulations published at 43 CFR Part 3260, as well as the Geothermal Resource Operational (GRO) Orders established under the Geothermal Steam Act, in part regulate geothermal fluid production and injection operations to prevent significant geologic impacts, such as seismicity or subsidence. GROs are described in the introduction (Section 1.0) of this document.

State/Local

The State of California has General Plan Guidelines, which can be used by counties and cities as a standard in developing their own General Plans. The General Plan Guidelines include a safety element section for the protection of the community from any unreasonable risks. Included in these risks are seismically induced surface rupture, ground shaking, ground failure, slope stability leading to mudslides and landslides, subsidence and other geologic hazards.

The Alquist-Priolo Special Studies Zones Act, which was enacted by the State of California in 1972 and renamed the Alquist-Priolo Earthquake Fault Zoning Act in 1993, was passed to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The act requires the State Geologist to delineate earthquake fault zones by regulation along active faults within the state and to issue appropriate maps. For the purposes of this Act, an active fault is one that has moved in the last 11,000 years (Holocene time) (California Department of Conservation 1996).

3.3 Hydrology and Geothermal Resources

REGIONAL HYDROLOGY

Surface Water

The Medicine Lake Highlands area is notable for its lack of permanent surface water drainages. The surface materials in the project area are very permeable, causing water to infiltrate the surface before distant travel. In general, the hydrologic gradient in the vicinity of the proposed action flows away from the Medicine Lake Volcano and Medicine Lake. The drainage patterns of the project area are discussed in detail in the hydrology Sections of the 1998 Fourmile Hill EIS/EIR and the 1999 Telephone Flat EIS/EIR (BLM et al 1998 and BLM et al 1999).

Medicine Lake is the largest body of water within 12 miles of the proposed action well sites, and it is located approximately 1.5 miles west of the closest well site (87-13). At an elevation of 6,676 feet above sea level, Medicine Lake represents the lowest elevation within the volcanic basin. Other surface water bodies in the region include Little Medicine Lake (elevation 6,682 feet), Bullseye Lake (elevation 6,735 feet), and Blanche Lake (elevation 6,742 feet). There is also a large dry lakebed, Arnica Sink, located 1.5 miles east of Medicine Lake at an elevation of 6,696 feet.

Medicine Lake water is considered to be of good quality with very good clarity, naturally low nutrient levels, and good buffering capacity. Water quality has also been surveyed in Little Medicine Lake, Bullseye Lake, and Blanche Lake. All of the lakes have good water quality with TDS concentrations of 12-24 mg/l (Cosens-Gallinatti 1984 from BLM et. al 1999).

There are six springs in the project vicinity:

- Paynes Springs I, II, and III,
- Schonchin Spring,
- Crystal Springs,
- Unnamed spring.

Paynes Springs is the source of Paynes Creek, a perennial creek approximately two miles long. Other streams in the project area are intermittent, only flowing after snowmelt and as intense storm runoff. Table 3.3-1 lists the surface water features in the Medicine Lake highlands, their elevation, use, and distance to closest project well site. Figure 3.3-1 schematically shows the location of project vicinity water features compared to the location of the well sites. Well site 87-13 is the closest existing well site to all of the water features in the project vicinity. Well site 85-33 is the closest new well site to several of the water features in the project vicinity.

Table 3.3-1: Elevation and Uses of Surface Water Features in the Medicine Lake Highlands

Surface Water	Elevation	Surface Water Uses	Approximate Distance to Closest Project Well Site
Medicine Lake	6,676 ft. (2035 m)	Domestic Use, Recreation, Fish Habitat	1.5 miles to well site 87-13
Little Medicine Lake	6,682 ft (2037 m)	Recreation, Fish Habitat	1.8 miles to well site 85-33
Bullseye Lake	6,735ft (2053 m)	Recreation, Fish Habitat	0.7 miles to well site 87-13
Blanche Lake	6,742 ft (2055 m)	Recreation	0.5 miles to well site 87-13
Paynes Spring I	6,558 ft (1999 m)	Paynes Creek: Recreation, Fish Habitat	0.5 miles to well site 87-13
Paynes Spring II	6,471 ft (1972 m)	Paynes Creek: Recreation, Fish Habitat	0.6 miles to well site 87-13
Paynes Spring III	6,678 ft (2035 m)	Seep Only-No identified Use	0.3 miles to well site 87-13
Schonchin Spring	6,820 ft (2079 m)	Domestic Use	1.3 miles to well site 85-33
Crystal Spring	6,860 ft (2,091 m)	Crystal Spring Creek: Domestic Use, Recreation, Fish Habitat	1.8 miles to well site 85-33
Unnamed Spring	6,700 ft (2042 m)	No identified Use	2.0 miles to well site 85-33

SOURCES: Medicine Lake-Blanche Lake Elevation Source: Topographic Map, 7.5 Minute series, Medicine Lake Quadrangle California, Siskiyou County, 1988 Provisional Edition
Paynes Spring I-Unnamed Spring Elevation Source: Schneider and McFarland 1996
Surface Water Uses Source: USFS and BLM 1994
Approximate Distance Source: Wardlow 2002a
www.topozone.com 2002
www.maptech.com 1989-2002

The proposed project area does not include any floodplains, wetlands /riparian areas, or Wild and Scenic River areas.

Groundwater

Within the basin surrounding Medicine Lake, the depth to the first major aquifer is generally 200 feet below ground surface (bgs) (BLM et al. 1995). On the upper flanks of the basin, the groundwater table is erratic and varies from about 300 feet to 1000 feet. At the base of the Medicine Lake volcano, the groundwater table is approximately 500 feet.

Wells located in Arnica Sink are typically used for withdrawing water for uses in the Medicine Lake Highlands. Calpine privately owns a well in Arnica Sink that was developed under an exploration Plan of Operation on leases for use in exploration and possible development.

GEOTHERMAL RESOURCES

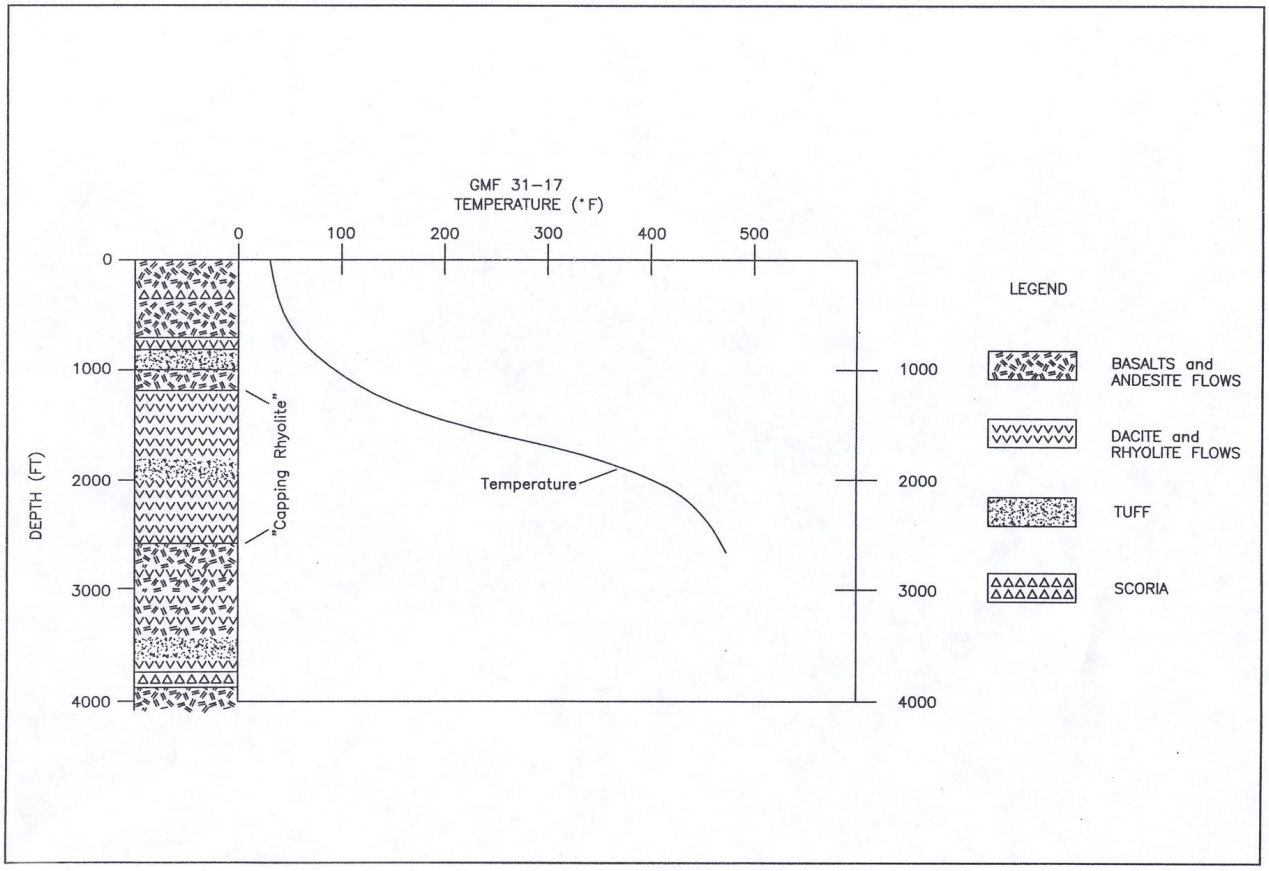
A geothermal resource can be defined as a concentration of natural heat from the earth that can be extracted and utilized economically. Young volcanism focused along regional fault systems is a common characteristic of productive geothermal resources throughout the world. Similar conditions at the Glass Mountain KGRA favor the development of high-temperature hydrothermal systems.

Geothermal systems require a heat source, water as a transportation mechanism, and a naturally permeable reservoir within the rocks. In most geothermal systems, the heat source is a body of magma or hot rock at a distance of several miles below the earth's surface. Water becomes heated at depth where hydrostatic pressures keep it in the liquid state at temperatures above that of the boiling point of water at the earth's surface. The fluid may remain in circulation beneath the earth's surface or will sometimes leak to the surface in the form of geysers, fumaroles, and hot springs. What allows the movement of the fluids, and hence the transfer of the magmatic heat, is the reservoir within the rocks. Unlike oil and gas reservoirs or groundwater aquifers, which are usually found within layers of porous rock, geothermal reservoirs are usually controlled by rock fractures.

The areal extent of the geothermal reservoir depends upon the geometry of the heat source and fractured reservoir volume. In order to develop geothermal resources it is necessary to first test areas for subsurface temperature distribution. This is usually accomplished by drilling temperature gradient or core holes. These wells do not produce fluids, and are not generally tested for fluid production capability. If the temperature results are encouraging, larger diameter holes are then drilled and the resource is tested at the surface to determine its production capabilities and characteristics. Project well site 31-17 was previously surveyed for temperatures conducive to geothermal development. Figure 3.3-2 shows the temperature gradient found at well site 31-17. Steep temperature gradients such as those found at 31-17 indicate that fluids are moving through the rock, indicating both the temperatures and permeabilities required for a geothermal reservoir.

The geothermal resource under Glass Mountain is believed to be heated by a small magma chamber. Table 3.3-2 presents a chemical analysis of the thermal water produced from existing project test well 87-13 in the proposed Telephone Flat Geothermal Development Area. This chemical analysis and similar analyses at other previously investigated well sites indicate that certain constituents such as chloride, silicon dioxide, sodium, potassium, and lithium, are present in the Glass Mountain fluids at concentrations typical of dilute liquid-dominated geothermal systems hosted by young volcanic rocks.

Figure 3.3-2: Lithologic Profile and Temperature Gradient for Well 31-17.



SOURCE: Personal Communication, Alex Schrieder, Jr., CalEnergy Company, Inc., January 1998

Table 3.3-2: Chemical Analyses for Well 87-13 – Medicine Lake Caldera

Constituent	Concentration (parts per million)
Silica	582.3
Sodium	632.0
Potassium	107.7
Calcium	7.9
Magnesium	0.1
Bicarbonate	49.0
Sulfate	46.9
Chloride	1021.2
Lithium	3.1
pH	8.6

SOURCE: BLM et al. 1995

REGULATORY FRAMEWORK

Federal Setting

Underground Injection Control Program. The U.S. Environmental Protection Agency Underground Injection Control Program regulates injection of spent geothermal fluids and treated sewage wastes into injection wells. The BLM acts on behalf of the EPA for permitting, monitoring, and ensuring proper construction and maintenance of those wells. BLM is also responsible for permitting and monitoring geothermal production wells.

All activities associated with the project would also be conducted in accordance with applicable regulations, guidelines, and generally accepted best management practices, including those in the Water Quality Control Plan for the Central Valley Region. The Water Quality Control Plan, or Basin Plan, applies to the proposed project sites, and include objectives, guidelines, and policies to prevent the degradation of surface waters and groundwater. Applicable portions of the plan includes guidelines and policies regarding:

- Waste discharge prohibitions
- On-site waste treatment and disposal practices
- Action plans for accidental spills and contingencies
- Action plans and discharge prohibitions for construction activities

Klamath and Modoc National Forest Land and Resource Management Plans

As stated in the introduction of this document (Section 1.0), both the Klamath and Modoc Land and Resource Management Plans contain forest wide and focused standards and guidelines according to each resource. Every proposed project in a national forest must comply with USFS direction.

State/ Local Setting

The primary agency for regulating surface water and groundwater pollution in California is the Regional Water Quality Control Board (RWQCB). The State Water Resources Control Board (SWRCB) delegates authority for implementation of regulations to the RWQCB, but creates general policies and plans. Once approved, these water quality control plans are implemented and enforced by the nine RWQCBs. The SWRCB and RWQCB are agencies within the California Environmental Protection Agency (CalEPA). The RWQCB determines allowable concentration limits for effluents, issues permits, and enforces the regulations. As stated above, the regional board that regulates the proposed action is the Central Valley Regional Water Quality Control Board (CVRWQCB). The existing CVRWQCB Waste Discharge Order for the Glass Mountain KGRA is provided in Appendix A.

Porter-Cologne Water Quality Control Act of 1998. The Porter-Cologne Act established the jurisdiction of the nine California RWQCBs, granting them the authority to issue Waste Discharge Requirements (WDRs) that impose annual discharge fees and establish discharge limits, operation, and maintenance requirements for treatment equipment, and monitoring, record keeping, and reporting requirements. Discharge of waste to land, such as septic leach fields, must comply with the WDRs.

California Safe Drinking Water and Toxics Enforcement Act (Prop. 65). Through Cal EPA under the Office of Environmental Health Hazard Assessment (OEHHA) administration, actions are prohibited that contaminate drinking water with chemicals known to cause cancer or possessing reproductive toxicity.

3.4 Cultural Resources

INTRODUCTION

The proposed action would take place in the Medicine Lake Highlands (see Figure 1.1-1). The Medicine Lake Highlands formed as a result of numerous and complex volcanic events, with significant eruptions having occurred as recently as a few hundred years ago. The volcanic activity resulted in obsidian deposits that have been used for tool manufacture by American Indians. The high elevation of the Highlands has seasonally restricted use of this area in both prehistoric and historic times to generally the summer and early fall months.

BACKGROUND

Cultural Resource Studies in the Project Area

Several cultural resource studies have been conducted in the Medicine Lake Highlands in response to proposed geothermal exploration projects in the area and USFS management activities (such as logging). The Fourmile Hill Geothermal Exploration and Development Projects and the Telephone Flat Geothermal Exploration and Development Projects are the related projects in the vicinity for which extensive cultural resource studies have been completed. Literature research and field surveys were conducted for both study areas.

Memorandum of Agreement

The USFS, BLM, SHPO, and the Advisory Council on Historic Preservation (Council) developed a Memorandum of Agreement (MOA) regarding the Fourmile Hill Geothermal Development Project. The MOA stipulates that the following measures are carried out:

- A Historic Properties Management Program (HPMP) for the Medicine Lake Highlands that addresses the need to define cultural values, resolve Traditional Cultural Property (TCP) boundaries, identify methods to protect and enhance cultural values for all projects regardless of whether or not the geothermal development is implemented
- Resolution of project effects on historic properties which is specific to the geothermal development and which outlines measures to ensure environmental effects from the project are addresses
- Administrative stipulations

Historic Properties Management Plan. Included as part of the HPMP would be the stipulation that the USFS and BLM shall evaluate proposed projects on USFS or BLM lands, or under the agencies' jurisdiction or control, for impacts to cultural values of and to other historic properties in the Highlands. In making its evaluations, the USFS will proceed in accordance with its Regional Programmatic Agreement (Programmatic Agreement among the USFS Pacific Southwest Region, SHPO, and the Council regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region), and the BLM will proceed in accordance with its BLM/SHPO State Protocol (State Protocol Agreement Between the California State Director of the BLM and the SHPO Officer Regarding the Manner in which the BLM Will Meet Its Responsibilities under the National Historic Preservation Act and the National Programmatic Agreement Among the BLM, the

Council, and the National Conference of State Historic Preservation Officers). If the USFS or BLM determines that any project may have an adverse effect on the traditional cultural values of, or on any other historic property in, the Highlands, the USFS or BLM will promptly notify the other parties to the MOA and request their comments on the proposed action, and proceed in accordance with 36 CFR 800. The HPMP has not been finalized as of May 2002.

Resolution of Effects. If the USFS and/or BLM approve the project, the approving agencies would ensure that the following effects of the project are resolved:

- Auditory effects
- Visual effects
- Effects on access
- Effects on archaeological sites
- Effects on air and water quality
- Effects on plants and wildlife

The approving agencies would also ensure that the following are fulfilled:

- Additional identification (for project elements not et subject to full effects investigation)
- Update of contingency plans
- Restoration of lands upon decommissioning
- Mitigation monitoring
- Establishment of a fund to reimburse the Tribes and the Coalition for their work in implementing stipulations in the MOA
- Reclamation bonding for Calpine and any successor(s)

Determination of Eligibility

The USFS prepared a Determination of Eligibility (DOE) for the National Register of Historic Places (NRHP) for two areas in relation to the proposed geothermal development in the Medicine Lake Highlands. The two areas included 1) Medicine Lake Highlands area, and 2) Timber Mountain. The MOA incorporates knowledge acquired through the DOE. The Determination of Eligibility was based on ethnographic information collected by Theodoratus, et al. (1996 and 1997; published 1998) during interviews with Pit River, Modoc/Klamath, and Shasta tribal members. The USFS originally proposed that 29 "traditional cultural properties" or TCPs situated within the Medicine Lake Highlands and Timber Mountain, collectively, were eligible for the NRHP as a "discontiguous district". The areas were tied together due to their importance for past and present Native Amercian use and values and were eligible as individual "islands" within the larger Medicine Lake Highlands/Timber Mountain area.

SHPO proposed that a more appropriate designation for the area would be as a "contiguous" district, one that would recognize the importance of the intervening landscape, for the Medicine Lake Highlands area, and a separate archaeological district for Timber Mountain. This proposal took into account the passage of traditional users from one location to another. Under the "contiguous" district Determination of Eligibility, not just the individual TCPs would be eligible, but the whole landscape within the boundaries of the district itself. The resulting Medicine Lake Area Traditional Cultural Places District

to be eligible for listing on the National Register of Historic Places by the National Park Service has yet to be determined in conjunction with the development of the HPMP. The Determination of Eligibility is discussed in further detail in the Traditional Cultural Values sections of the Fourmile Hill and Telephone Flat Geothermal Development Project EISs/EIRs.

Most of the information provided in this cultural resources existing environment section is summarized from the MOA and the Fourmile Hill Geothermal Exploration Project EIR/EIS and the associated *Cultural Resources Sample Survey and Sensitivity Assessment for the Fourmile Hill Geothermal Project, Modoc and Klamath National Forests* report prepared by Far Western Anthropological Research Group, Inc. (FWARG 1996). In addition to the background research and surveys FWARG conducted in the area, several reports on the study area were previously completed for Calpine Corporation and were used by FWARG to review the archaeological resources of the study area. The reports used to provide information on the study area and to compile this section are listed below:

- *Biological and Cultural Resource Assessments for the Calpine Transmission Line Project*, prepared by S.J. Bianco and D. Sterner for Calpine Corporation, Santa Rosa, CA in 1996 (Bianco et al. 1996)
- *Supplemental Cultural Resources Study for the Calpine Geothermal Project within the Glass Mountain KGRA, Siskiyou County, California*, prepared by T.M. Origer for Calpine Corporation, Inc. Santa Rosa, CA in 1995 (Origer 1995)
- An Archaeological Survey of Potential Temperature Gradient Hole Drilling Sites within the Glass Mountain KGRA, Siskiyou County, California, prepared by T.M. Origer for Calpine Corporation, Inc. Santa Rosa, CA in 1994 (Origer 1994)

Information is incorporated into this cultural resource section by reference from the following documents:

- Fourmile Hill Geothermal Development Project Final EIS/EIR (BLM et al. 1998)
- Fourmile Hill Geothermal Exploration EA/IS (BLM et al. 1995a)
- Telephone Flat Geothermal Development Project Final EIS/EIR (BLM et al. 1999)
- Glass Mountain Unit Geothermal Exploration Project EA/IS (BLM et al. 1995)
- Memoradum of Agreement among the U.S. Department of Agriculture, Forest Service, the U.S. Department of the Interior, Bureau of Land Management, California State Historic Preservation Officer and the Advisory Council on Historic Preservation regarding the Fourmile Hill Geothermal Development Project (USFS et al. 2000)
- Medicine Lake Highland and Timber Mountain Ethnographic Report for the Fourmile Hill Geothermal Development Project, Siskiyou and Modoc Counties, California (Theodoratus et al. 1998)

AMERICAN INDIAN USE PRIOR TO THE MID-1800'S

Site types found on the National Forests range from winter village complexes to scattered hunting stations, tool manufacturing sites, and plant food processing areas. They also include petroglyphs, pictographs, bedrock mortars, rock shelters, caves, and obsidian and basalt quarries. Of particular importance are the well-known obsidian quarries at Glass Mountain.

The project vicinity offered important obsidian resources to prehistoric populations. Archaeological evidence in the project area indicates that the peak consumption of Medicine Lake Highland obsidian occurred between approximately 3,500 to 1,000 years ago. This evidence is supported by distribution patterns of the same period of Medicine Lake Highland obsidian found throughout prehistoric sites in northern California and southern Oregon. Many of the prehistoric sites recorded in the Medicine Lake Highlands are quarries associated with the obsidian flows. The quarries were heavily exploited for a time, and there is ample evidence of hunting. Further detail on prehistoric resources in the project area is provided in the Fourmile Hill and Telephone Flat Geothermal Development documents listed above.

HISTORIC

Modern-day influences on the Medicine Lake Highlands have been largely related to logging and pumice mining after approximately 1920, and contemporary recreational use. Historic themes that dominate many other parts of the state of California such as transportation (e.g., emigrant trails and railroads), water development (e.g., irrigation and flumes), ore mining, and associated settlements, are of little relevance to this area.

During the nineteenth century, Euro-Americans considered the project vicinity to be an area to travel through, or cross, rather than settle (Bunse 1996 in FWARG 1996). Early nineteenth century visitors were primarily composed of explorers and fur trappers. Transportation routes used during this period did not typically cross through the project area.

Railroad building and logging activities were the dominant activity in the project vicinity from the turn of the century until World War II. Railroad building began in the project area slightly before logging developments; logging soon followed in the late 1920s to support railroad construction. In 1932, the Great Northern and Western Pacific Railroads opened their collaborative track connecting Klamath Falls to Keddie, California. This railroad passes through the east end of the project area, west of Tionesta.

Large-scale commercial pumice mining began in the region in the 1930s. Throughout the 1930s and 1940s, pumice from the quarries in the Medicine Lake Highlands was shipped from Tionesta on the Great Northern Railroad.

Modern industrial use of the Medicine Lake Highlands is minor, and has been restricted primarily to railroad development, logging, and pumice mining from about 1920 to before World War II. This lack of development contributes to the area's current popularity for outdoor recreation (camping, hiking, fishing, hunting, etc.) (BLM et al. 1998).

TRADITIONAL CULTURAL VALUES

American Indian Use

The general vicinity of Medicine Lake provides evidence of at least 11,000 years of human occupation and use of the area. Except for the past 150 years of written history, the only record of this long human history in the area is the oral history of American Indians and the abandoned villages, camps and other remains left by native peoples.

The Medicine Lake area has historically been used by a variety of American Indian groups and tribes, including the Klamath, Modoc, Northern Paiute, Pit River groups, Shasta and

Wintun Tribes. Some of these groups have used the area on a temporary basis to obtain obsidian and other natural resources, while others have had more long-term occupation of the vicinity. All of these groups have rich cultural histories involving lifeways that have been adaptive of the environment. These American Indian groups seasonally occupied various temporary camps, returning to permanent villages in fall and/or winter. They generally returned to the same and seasonally occupied camping spots year after year. Food resources were used on a seasonal basis whenever and wherever they occurred.

American Indian Consultation and Concerns

Fourmile Hill Project. Consultations with local American Indian groups has been conducted regarding the Fourmile Hill Geothermal Development Project. Meetings were conducted in 1995 and 1996 with representatives from the Klamath and Pit River Tribes. Concerns were raised regarding geothermal operations impacts on spiritual activity and religious practices in the Medicine Lake Highlands. These concerns are further discussed in Section 4.4.

Telephone Flat Project. The consultation with the tribes for the Telephone Flat project is described in Section 3.6 American Indian Values of the 1999 Telephone Flat EIS/EIR. The following discussion summarizes the issues and concerns raised by American Indian groups during project consultations. Presentations and field trips were conducted in 1997 to present the Telephone Flat Project to the Pit River Tribe. USFS and BLM personnel attended the meeting, as well as CalEnergy representatives and members of the consultant team charged with preparing the 1999 Telephone Flat EIS/EIR. Additionally, an interview was conducted during December 1997 with one Klamath Tribes member who had conducted traditional activities in the Medicine Lake area.

The Klamath Tribes had three primary concerns about project development. These concerns included effects on spiritual uses as described in the American Indian Religious Freedom Act, impacts on ethnobotanical uses, and loss of access to sites. The Tribe also indicated that concerns raised previously regarding the Fourmile Hill project also applied to the Telephone Flat project. These concerns included alteration to the natural landscape, visual quality disruption, interference with spiritual solitude, destruction of cultural artifacts, noise pollution, wildlife harassment, wildlife habitat destruction, removal of wildlife from natural ranges or homes, adverse affects to natural groundwater sources, air pollution, damage or removal of ethnobotanical resources, and interruption of other tribal activities (e.g., camping, socializing, and gathering).

The tribes' concerns were regarding the protection the cultural values of the highlands; the tribal government did not express opposition to project development as mitigated. The Klamath Tribes have since signed a MOU with each project developer and expressed support for the projects as mitigated. Resolution No. 96-08-25 of the Pit River Tribe identifies Medicine Lake Highlands as a sacred site. The resolution refers specifically to the Fourmile Hill project, but its concerns about geothermal development having "an adverse effect on the physical integrity of the numerous sacred sites of the Medicine Lake Highlands" apply to the Telephone Flat project as well. Government-to-government consultation and tribal concerns are further described in Section 3.6 of the 1999 Telephone Flat EIS/EIR.

Previous Documentation

Ethnographic Report. The ethnographic research for the Medicine Lake Highlands and Timber Mountain areas was conducted to assist in the consultation process related to the Fourmile Hill Geothermal Development Project. The research was used to prepare the EIS/EIR analyses for the Fourmile Hill and Telephone Flat projects. The ethnographic study consisted of two stages. The first phase of the study involved a literature survey and an interview program. The second phase of the study included an on-site examination of those places considered culturally or spiritually meaningful to native groups based on information from the first phase, additional interviews, or examination of records.

Dr. Dorothea Theodoratus prepared an initial draft of the Medicine Lake Highland and Timber Mountain Ethnographic Report (Theodoratus and Emberson 1996) following her interviews with the Tribes. A final report (Theodoratus et al. 1998) was prepared after additional interviews and field investigations were conducted and comments from the tribes' review of the draft report were incorporated. The final report documents a number of issues relating to the cultural significance of the project area, including:

- Research methodology
- Ethnographic background
- Ethnographic data collected in the tribal interviews
- Concerns expressed by tribal members regarding potential effects of the Fourmile project
- Recommendations proposed by tribal members regarding the project and selection of alternative transmission line routes
- A bibliography of sources examined and used
- Appendices listing cultural places and a description of their significance and use, tribal persons interviewed, tribal resolutions, and ethnographic site forms for each site field verified.

The Ethnographic Report provides a strong foundation to assess the value and importance of the various cultural sites in the Medicine Lake region. Most importantly, the report and the supporting research document the traditional uses of the region by the local tribes.

Memorandum of Agreement and the Determination of Eligibility. In May 2000, a Memorandum of Agreement (MOA) was signed by the USFS, BLM, SHPO, and the Advisory Council on Historic Preservation. The MOA included stipulations applicable to cultural resources in the Fourmile project area. The USFS prepared a Determination of Eligibility (DOE) for the National Register of Historic Places (NRHP) for two areas in relation to the proposed geothermal development in the Medicine Lake Highlands. The two areas included the 1) Medicine Lake Highlands area, and 2) Timber Mountain. SHPO proposed that a more appropriate designation for the area would be as a "contiguous" district, one that would recognize the importance of the intervening landscape, for the Medicine Lake Highlands area, and a separate archaeological district for Timber Mountain. This "contiguous" district has yet to be determined. The Memorandum of Agreement and Determination of Eligibility are discussed as background information to this section.

American Indian Consultation for the Proposed Project

Federal Consultations. The BLM is currently conducting its tribal consultations regarding the proposed project. Communications to both tribal groups and environmental advocacy groups that have been made are presented in Table 3.4-1.

Table 3.4-1: BLM Tribal Consultations

Date	Contact
3/12/02	BLM representative discussed proposed exploration activities at Fourmile Hill with Pit River Tribal Council
3/25/02	BLM representative discussed proposed exploration activities at Fourmile Hill with Klamath Tribes Culture and Heritage Committee
4/10/02	BLM received copy of letter from Medicine Lake Citizens for Quality Environment, Inc. to Regional Water Quality Control Board concerning proposed exploration at Fourmile Hill
4/10/02	BLM received letter from Mt. Shasta Bioregional Ecology Center concerning proposed exploration at Fourmile Hill
4/16/02	BLM sent Calpine's POO to Pit River Tribe, Klamath Tribes, Shasta Tribe, Inc., Shasta Nation, Save Medicine Lake Coalition, Mount Shasta Bioregional Ecology Center and Native Coalition
4/17/02	BLM representative met with Pit River Tribal Chairman and discussed proposed exploration activities at Fourmile Hill
5/9/02	BLM received letter from Mt. Shasta Bioregional Ecology Center concerning exploration work at Fourmile Hill
5/10/02	BLM received letter from Medicine Lake Citizens for Quality Environment concerning exploration work at Medicine Lake
5/13/02	BLM received copy of letter from Mt. Shasta Bioregional Ecology Center to Regional Water Quality Control Board concerning exploration at Fourmile Hill
5/15/02	BLM received letter from Mt. Shasta Bioregional Ecology Center concerning exploration work at Fourmile Hill

SOURCE: BLM 2002

Proponent Consultations. On May 7, 2002 Calpine met with the Klamath Tribes' tribal council in their offices in Chiloquin, Oregon to discuss proposed activities this summer and the provisions of Calpine's past agreement with the Tribes. On May 11, 2002 Calpine met with the Shasta Tribe's council at a home near Ft. Jones, California to discuss the same issues that were discussed with the Klamath Tribes.

It was agreed that the tribes would nominate representatives to be included on the archaeological monitoring crew to monitor well pad construction activities this year.

Calpine would also use instructors from the tribes to conduct cultural sensitivity and heritage classes for supervisors and workers on site.

Calpine is in the process of setting up the cultural monitoring program, which would be in place when work begins on the ground. There would be monitors, which Calpine would compensate, from both the Klamath and Shasta tribes. Calpine is making arrangements for an instructor from the Klamath Tribes to hold a full day cultural sensitivity and heritage class for about 20 Calpine employees, who will be working in the area this summer. Calpine is currently making efforts to contact officers of the Pit River Tribe regarding archaeological monitors.

REGULATORY FRAMEWORK

Several laws and Executive Orders address the issue of consultation with local American Indian groups regarding any proposed project that may affect traditional religious practices or cultural resources, including:

- National Historic Preservation Act of 1996, as amended
- American Indian Religious Freedom Act of 1978
- Executive Order 13007
- Executive Order 12898
- National Environmental Policy Act
- California Environmental Quality Act

Klamath and Modoc National Forest Land and Resource Management Plans

The Klamath and Modoc Land and Resource Management Plans (LRMPs) contain forest wide and focused standards and guidelines according to each resource area. The introduction of this document (Section 1.0) describes both the Klamath and Modoc LRMPs. Every proposed project must comply with USFS direction from the resource management plans.

These Federal and state laws and the Executive Order are fully described in Section 3.6, Traditional Cultural Values of the Fourmile Hill EIS/EIR.

3.5 Biological Resources

INTRODUCTION

This section outlines the biological resources setting of the proposed project at both the proposed Fourmile Hill well sites (64-27 and 85-33) and the existing Telephone Flat well sites (68-8, 31-17, and 87-13). The vegetation and wildlife of the regional and local project area are described in this section. The regulatory setting, which includes state, federal, and local laws, regulations, and plans, is also discussed in the context of their applicability to the biological resources affected by the proposed project. The information presented in this section is derived from a compilation of environmental documents prepared for the Fourmile Hill, Telephone Flat, and Glass Mountain Unit geothermal exploration and development projects (e.g., BLM et al. 1995, 1995a, 1998, 1999; Siskiyou County 2001).

In general, the two new well site areas are similar in terms of their vegetation and wildlife resources. The proposed project sites have been logged and are located on areas of primarily disturbed soil, with little vegetation growth. Within the project sites themselves, there is little habitat left for the nesting or foraging of any wildlife and the select trees that have been left standing are snags, shelter wood, or seed trees (Figure 2.2-5). The forested areas surrounding the two well sites, however, contain biological resources that are described and discussed in this section.

VEGETATION

Regional Vegetation and Wildlife Habitat

The proposed action is located within the Glass Mountain KGRA in the Medicine Lake Highlands of the Klamath and Modoc National Forests in Siskiyou County. The Medicine Lake Highlands are recognized in the "Ecological Units of California" as a unique subsection of the Southern Cascades Section (USFS 1994). The Medicine Lake Highlands is a region characterized by high elevations (4,800 to 8,000 feet), high precipitation, deep winter snow pack, and a short summer growing season. These features, combined with a relatively cool sub-humid climate provide an environment that features high montane conifer forests as the dominant natural climax vegetation. Timber stands of varying composition and density characterize the majority of the higher elevations in the central portion of the basin and its associated ring of volcanic cones. Forest cover is interspersed with large bodies of barren lava flows. There are small inclusions of pumice flats, glacial lake sediments and weathered rock that are occupied by sparse communities of xeric shrub and herbaceous species. Montane chaparral colonizes recent burns, and there are isolated patches of riparian vegetation associated with small ponds and meadows. The regional vegetation is further described in the environmental documents that address the Fourmile Hill and Telephone Flat geothermal development projects referenced above.

Wildlife habitat in the area is generally seasonally suitable for bird and mammal species, such as goshawks, pine martens, and bats. Special habitat features such as large lava flows, cliffs, caves, rock outcrops, large defective trees, and large snags also are important for many wildlife species. Additional information on the wildlife of the region can be found in the Fourmile Hill and Telephone Flat project environmental documents listed above.

Vegetation at Fourmile Hill Well Sites

Surveys of the project area were conducted as part of extensive plant and animal studies for the Fourmile Hill exploration and development projects (BLM et al. 1995a, 1998; MHA 1999, Siskiyou County 2001). Surveys determined the likelihood of special-status species in the project area and allowed vegetation communities within the project area to be mapped. Sensitive vegetation communities were determined based on the following criteria:

- Classified as "high priority for inventory" in the CNDDB (CDFG 1996a)
- Appeared to meet the criteria for wetlands (including a prevalence of hydrophytes, hydric soils, and wetland hydrology)

Sixteen vegetation community types have been mapped in the vicinity of the Fourmile Hill well sites (see Table 3.5-1). Detailed descriptions of each community type, and identifications of the plant species typically found in each vegetation community are included in the survey documents referenced above.

Table 3.5-1: Vegetation Community Types Surrounding the Fourmile Hill Well Sites

Lodgepole pine forest
Ponderosa pine forest
Red fir forest
Ponderosa pine plantation
Upper montane mixed conifer forest
Northern juniper woodland
Meadow
Sagebrush scrub
Montane chaparral
Rabbitbrush scrub
Rock outcrops
Vernal marsh/stockpond
Herbaceous
Disturbed area
Lower montane mixed conifer forest
Agriculture/planted

SOURCE: Leitner 1997

The Fourmile Hill project area is located in the Klamath National Forest in the Medicine Lake Highlands (Figure 2.2-10). The proposed project would take place on sites that were previously cleared of vegetation and clear-cut areas. The project area is vegetated primarily with upper montane mixed conifer forest that has been selectively logged (see Figure 2.2-1). The vegetation community types found in the well site areas are:

- Lodgepole pine forest
- Red fir forest

- Rock outcrops

Lodgepole pine forest is found in the level and gently sloping parts of the area. Red fir forest is located in a group of small stands in the east-central part of the well site areas on steep slopes, and in a large stand in the west-central part of the well site areas. This large stand of red fir forest extends to the north and west of the well site area. Rock outcrops were mapped primarily in the southern portion of the well site areas. The largest rock outcrop is a recent lava flow, sparsely vegetated and consisting of very rough, unweathered rock. No sensitive plant communities were found within the Fourmile Hill well sites area (BLM et al 1998).

Well Pad Site 85-33. This previously disturbed and partially cleared site is located just to the southeast of Grouse Hill and south of the Fourmile Hill area. The site is west of USFS road #44N50 and sits amid a stand of lodgepole pine (Figure 2.2-10). Terrain in the vicinity of the site contains rocks, lava flows, and talus piles, as well as timbered areas.

Well Pad Site 64-27. This logged and thinned site has been previously disturbed. It is set amid a lodgepole pine stand just east of road Forest Route 49 in the Fourmile Hill development area.

Vegetation of Telephone Flat Well Sites

Environmental information for the Telephone Flat well sites area is derived from surveys and studies conducted for the Telephone Flat Geothermal Development Project EIR/EIS (BLM et al. 1999) and Glass Mountain Unit Geothermal Exploration project EA/IS (BLM et al. 1995).

Three vegetation community types represent the majority of the Telephone Flat project area:

- Lodgepole pine forest
- Red fir forest
- Forest characterized by a co-dominance of lodgepole pine and red fir.

The 85-33 well site location was cleared in the fall of 2001 in preparation to drill a TGH and the 64-27 well site location was logged sometime in the past. Both are located amid disturbed soil (Figure 2.12-7). No sensitive plant communities have been found within the Telephone Flat well sites area (BLM et al. 1999).

Well Pad 68-8 Site. This pad occurs on the south end of a large clear-cut (currently regenerating to lodgepole pine). Development at the site consists of an enclosed well pad with a sump. The surface of the pad outside the enclosure is composed of gravel and supports only occasional scattered vegetation, including some stunted lodgepole seedlings and Ross's sedge, a common local plant species. Inside the enclosure the most conspicuous vegetation is a dense band of graminoids near the water's edge. Above this band, on the drier rising banks, is a moderate cover of a variety of forbs and graminoids. No special status plant species occur at this site. No noxious weed species have been introduced.

Well Pad 87-13 Site. This pad is located in a leveled area within lodgepole pine forest. Development consists of a well and sump, within a fenced enclosure. The area is bounded on the north, east, and south by cut slopes varying from 3-8 feet in height. On the west side is a deep steep-sided pit which once served as a gravel quarry. Just west of this pit, in

a topographical trough, is a narrow stringer meadow through which water seasonally drains east into the gravel pit. A colony of ash penstemons, a special-status species described below, border this meadow that is quite remote from the developed well pad.

The surface of the pad, outside the sump enclosure, supports very little vegetation. There are no existing trees or shrubs, and only a very sparse herbaceous component (<2% cover) is present. These scattered forbs and graminoids are most conspicuous on the bordering cut banks, where individuals and/or groups of two special status plants are resident. Hall's sedge, a special status species described below, has colonized all three of the cut banks. A total of approximately 15 square feet of area is occupied by this species on the east cut slope, with a lesser amount located above the bank at the fringe of the bordering lodgepole pine stand. On the north side, individuals and a single clump of Hall's sedge occupy a total of several square feet on the bank, and 20-plus square feet above it. Only three isolated plants of this species are resident on the south cutback (at the extreme west end), though additional individuals were scattered within the open lodgepole stand above. A single plant of ash penstemon is resident on the east cut-bank. All these special status plants are located on or above the bordering cut banks, off the floor of the pad, and outside any activity zones.

The vegetation within the sump enclosure contrasts in part with that without. Completely surrounding the pond, beginning at the water's edge, is a dense 3- to 4-foot band of herbaceous vegetation that includes a fairly diverse assemblage of water-dependent species (*Carex, Scirpus, Eleocharis, Typha, Potamogeton*). Outside this green donut, but within the sump enclosure on somewhat drier disturbed soil, is a scattering of common herbs including *Poa secunda*. Resident in this latter area are several small groups of ash penstemon and a single clump of Hall's sedge. No noxious weeds have been introduced onto this developed well pad or the surrounding environment.

Well Pad 31-17 Site. This site is located on a leveled area bounded on three sides by relatively flat terrain with open stands of red fir-lodgepole pine forest, and on the west by a hill occupied by a moderately dense stand of large mature red fir. Development at this site consists of an enclosed well and large sump. The area outside the sump has a gravelly-cobble surface and supports only a scattering of graminoids and forbs. Within the enclosure, a green halo of dense herbaceous growth, 3-6 feet wide, almost completely encircles the water in the sump. Outside this initial border, on drier soils, is an open band that includes a variety of forbs as well as lodgepole seedlings. No special status plants are resident on this site. No noxious weeds have been introduced to the site.

Special-Status Plant Species at Fourmile Hill and Telephone Flat Sites

Special status species occur or have the potential to occur in the Fourmile Hill and Telephone Flat areas. These species are listed in Table 3.5-2. Taxa were considered to be special-status species if they were classified as one or more of the following:

- Listed, or proposed for listing, as Threatened, Endangered, or Species of Concern (formerly listed as Candidate List 1 or 2) under the Endangered Species Act by the U.S. Fish and Wildlife Service (CDFG 1996a and 1996b)
- Listed, or proposed for listing, as Rare, Threatened, or Endangered under the California Endangered Species Act (CDFG 1996b)
- Listed as “Sensitive” or “Special Interest” by the USFS (Sanger 1996, pers. com., Williams 1996, pers. com.)

- Listed as "Survey and Manage", Category 2, in the Northwest Forest Plan (USFS 1996)
- Listed as Category 1, 2, 3, or 4 of the CNPS *Inventory of Rare and Endangered Vascular Plants of California* (Skinner and Pavlik 1994)
- Meeting criteria for listing under the California Environmental Quality Act (CEQA Guidelines, Section 15380)
- Identified in pertinent resource management plans, such as the Northwest Forest management Plan or National Forest resource plans

Several special status vascular plant species have been identified within the project area near the proposed or existing well sites, as mentioned in the individual well site descriptions above (Table 3.5-2). The ecology of each of the observed or potential species listed in Table 3.5-2 is described in more detailed information in the referenced Fourmile Hill and Telephone Flat project survey documents.

Table 3.5-2: Special-Status Plant Species Known to Occur or with the Potential to Occur in the Project Area

Species	Federal [1]	State [2]	USFS [3]	CNPS [4]	Present in project area? [5]
Ash penstemon *(Penstemon cinicola)*	C3c	-	SI	4	4MH (P) TF (+)
Baker's globe mallow *(Iliamna bakeri*)	-	-	SI	4	-
Boggs Lake hedge-hyssop *(Gratiola heterosepala)*	C3c	CE	S	1B	4MH (-) TF (+)
California pinefoot *(Pityopus californicus)*	C3c	-	SI	4	4MH (P) TF (-)
Columbia yellow cress *(Rorippa columbiae)*	SC	-	S	1B	-
Cusick's stickseed *(Hackelia cusickii)*	-	-	S1	4	-
Egg Lake monkeyflower *(Mimulus pygmaeus)*	SC	-	S	1B	-
Gray penstemon *(Penstemon cinereus)*	-	-	SI	4	-
Hall's sedge *(Carex halliana)*	-	-	SI	2	4MH (+) TF (+)
Hillside arnica *(Arnica fulgens)*	-	-	SI	2	-
Kruckeberg's sword fern (*Polystichum krukbergii*)	C3	-	SI	4	-
Liddon's sedge *(Carex petaseta)*	-	-	SI	2	4MH (P) TF (-)

Species	Federal [1]	State [2]	USFS [3]	CNPS [4]	Present in project area?[5]
Mexican mosquito fern (*Azolla mexicana*)	-	-	SI	4	-
Modoc County knotweed *(Polygonum polygaloides ssp otericum)*	-	-	S	1B	-
Nelson's pepperwort (*Marsilea oligospora*)	-	-	SI	3	-
Newberry's cinquefoil *(Potentilla newberryi)*	-	-	SI	2	-
Northern daisy (*Trimorpha acris* var. *debilis*)					-
Playa phacelia *(Phacelia inundata)*	-	-	SI	2	-
Profuse-flowered pogogyne *(Pogogyne floribunda)*	-	-	SI	1B	-
Stoloniferous pussytoes *(Antennaria flagellaris)*	-	-	S	4	-
Scalloped moonwort *(Botrichium crenulatum)*	SC	-	SI	1B	-
Geyer's sedge *(Carex geyeri)*	-	-	SI	4	-
Great Basin claytonia *(Claytonia umbellata)*	-	-	SI	1B	-
Tallus colllomia *(Collomia larsenii)*	C3c	-	S	2	-
Hot rock daisy *(Erigeron inornatus var. calidipetris)*	-	-	SI	4	-
Prostrate buckwheat *(Eriogonum prociduum)*	-	-	S	1B	-
Ash creek ivesia *(Ivesia paniculata)*	SC	-	S	1B	-
Shasta beardtongue *(Penstemon heterodoxus)*	-	-	SI	4	-
Fleshy sage *(Salvia dorrii var. incana)*	-	-	SI	3	-
Sugar stick (*Allotropa virgata*)	-	-	SM	-	4MH (+) TF (+)
Susanville milk-vetch *(Astragalus inversus)*	-	-	SI	4	-
Twin arnica (*Arnica sororia*)	-	-	SI	2	-
Tall woolly marbles (*Psilocarphus elatior*)	-	-	SI	4	-

Species	Federal [1]	State [2]	USFS [3]	CNPS [4]	Present in project area? [5]
Volcanic daisy *(Erigeron elegantulus)*	-	-	SI	4	-

[1] Federal: SC-Species of Concern (formerly Candidate Lists 1 and 2); C3c-Candidate List 3, not a candidate because too widespread and/or not threatened

[2] State: CE-Endangered

[3] USFS: S-sensitive (on either the Modoc or Klamath National Forest); SI-Modoc National Forest special interest plants; SM-survey and manage, Category 2, Northwest Forest Plan

[4] CNPS: 1B-plants rare, threatened or endangered in California and elsewhere; 2-rare, threatened or endangered in California but not elsewhere; 3-plants about which more information is needed, a review list; 4-plants of limited distribution (a watch list)

[5] 4MH = Fourmile Hill well sites area, TF = Telephone Flat well sites area; P = potentially present in area, + = observed present in area/well sites. - = Not present/observed in area

SOURCE: BLM et al. 1995a, BLM et al. 1999, Leitner 1996

Special-Status Non-vascular Plants. The false truffle, a special-status fungus, occurs or may occur within the Fourmile Hill project area. Potential habitat for the false truffle is found in red fir forest. It is usually observed in brief periods during the fall, and it has been observed in the vicinity of the well site area (Stout 1996, pers. com.).

Four species of Survey and Manage fungi were located within the Telephone Flat well site area: *Cantharellus subalbidus, Gomphus kauffmanii, Sarcodon fuscoindicum, and S. imbricatum*. All four species are classified as "Component 3," meaning no specific field surveys are required prior to ground disturbing activities. Other lichen and fungus species listed in the Northwest Forest Plan (USFS and BLM 1994) may occur in the late seral forests in the well site areas. Survey protocols have not yet been developed for these species, and the USFS has not fully assessed their status in this area.

Wildlife Habitat of Fourmile Hill and Telephone Flat Well Sites

Several forest types provide wildlife habitat in the area (BLM et al. 1995a, BLM et al 1998). These forest types include predominantly lodgepole pine forest and upper montane mixed conifer forest, but few areas of red fir forest also exist. The most notable habitat located in the well site area is two relatively undisturbed red fir stands. The USFS is monitoring an historical site, located beyond a 0.5-mile radius from the proposed site, which is used by special status goshawks.

Wildlife habitat within the well site area is generally suitable for bird and mammal species typical of disturbed early to mid-seral higher elevation coniferous forest. Almost all of the area has been selectively logged over the past few decades, so that little late seral forest remains. Some mature trees and large snags are scattered through harvested areas, but canopy closure is relatively low and small trees dominate most stands.

Additional habitats in the well site areas include other small areas of rock outcrops scattered throughout the area. This type of habitat may provide appropriate habitat for various special-status bat species in the area. No aquatic or riparian habitats are present within the well site area. In general, wildlife habitat types within the project area have been classified and described for the analysis of the proposed action in accordance with

the CDFG California Wildlife Habitat Relationships System (CWHR). More detailed description of the habitat types in the project area is contained in the environmental documents prepared for the Fourmile Hill geothermal development projects (e.g., BLM et al. 1995a, 1998, MHA 1999, Siskiyou County 2001).

Extensive surveys for wildlife species have been conducted in the well site area and in the surrounding region (BLM et al. 1995a, 1998). More detailed descriptions of the local wildlife species in the project area are contained in the Fourmile Hill environmental documents listed above. Additional information on special-status wildlife species that are known to occur in the project area is available in the *Modoc National Forest Land and Resource Management Plan – Final Environmental Impact Statement* (USFS 1991) and *Klamath National Forest Land and Resource Management Plan - Final Environmental Impact Statement* (USFS 1994).

Wildlife species associated with the montane forest communities are found within the Telephone Flat well sites area and are similar to those found at the Fourmile Hill project areas (e.g., BLM et al. 1999). In addition, timber management practices at Telephone Flat have resulted in limited amounts (35-40 acres) of undisturbed late-successional red fir forest habitats being retained, and contributed to the lack of diversity of habitats within the Telephone Flat area.

There are two (2) special status management areas within the general vicinity of the project, but none within the well site area itself. The first is a Bald Eagle Management Area located on the south side of Medicine Lake, approximately five (5) miles from the well site area. The second is the Medicine Lake Highlands Managed Late-Successional Area (MSLA). The MSLA contains 19,917 acres south of the well site area. There are three northern spotted owl (NSO) activity areas within the MSLA, but no known nesting pairs are present therein.

WILDLIFE

Special-Status Wildlife Species of Fourmile Hill and Telephone Flat Areas

There are a number of special status wildlife species that either occur within or have the potential to occur within the Fourmile Hill and Telephone Flat well site areas. For purposes of this analysis, animal taxa are considered to be "special-status" if they fit one or more of the categories listed above in the vegetation section. These special status wildlife species are identified in Table 3.5-3. Other special status species, such as those Management Indicator Species (MIS) identified in the Modoc and Klamath National Forest Land and Resource Management Plans (LRMPs) and those listed or proposed for Federal designation that do not occur or do not have suitable habitat in the project area are listed in Appendix D. A brief explanation of the reason for their absence in the project area is provided in Appendix A; more detailed information on these species requirements and ecologies are presented in the Fourmile Hill and Telephone Flat survey and environmental documents and LRMPs (USFS 1991, 1994).

A summary of special status animals' use of the Fourmile Hill and Telephone Flat areas is presented in Table 3.5-4. More detailed descriptions of the ecology, characteristics, and requirements of all of the species listed in Table 3.5-3 and 3.5-4 may be found in the referenced Fourmile Hill and Telephone Flat project documents.

Table 3.5-3: Special Status Wildlife Species Occurring or With the Potential to Occur Within the Region of the Project Area

Species	Federal[1]	California[2]	USFS[3]
Birds			
Bald eagle (Haliaeetus leucocephalus)	FT	SE	—
Blue grouse (Dendrapagus obscurus)	—	—	MIS
Cooper's hawk (Accipiter cooperii)	—	CSC	—
Golden eagle (Aquila chrysaetos)	—	CSC	MIS
Great gray owl (Strix nebulosa)	—	SE	R5
Hairy woodpecker (Picoides villosus)	—	—	MIS, SA
Loggerhead shrike (Lanius ludovicanus)	FSC	CSC	SA
Northern goshawk (Accipiter gentilis)	FSC	CSC	R5
Northern spotted owl (Strix occidentalis caurina)	FT	CSC	—
Osprey (Pandion haliaetus)	—	CSC	MIS
Pileated woodpecker (Dryocopus pileatus)	—	—	SA
Sage grouse (Centrocercus urophasianus)	—	CSC	MIS
Swainson's hawk (Buteo swainsoni)	—	ST	MIS, SA
Bats			
Fringed myotis (Myotis thysanodes)	FSC	CSC**	PB
Long-eared myotis (Myotis evotis)	FSC	—	PB
Long-legged myotis (Myotis volans)	FSC	CSC*	PB
Pallid bat (Antrozous pallidus)	—	CSC	PB
Silver-haired bat (Lasionycteris noctivagans)	—	—	PB
Spotted bat (Euderma maculatum)	FSC	CSC	—
Townsend's big-eared bat (Corynorhinus townsendii)	FSC	CSC	PB
Western mastiff bat (Eumops perotis)	FSC	CSC	—
Western small-footed myotis (Myotis ciliolabrum)	FSC	—	—
Other Mammals			
American badger (Taxidea taxus)	—	CSC	—
American marten (Martes americana)	—	—	R5
Mule deer (Odocoileus hemionus)	—	—	MIS
Oregon snowshoe hare (Lepus americanus klamathensis)	—	CSC	—
Pacific fisher (Martes pennanti pacifica)	FSC	CSC	MIS
Pronghorn (Antilocapra americana)	—	—	MIS, SA

Notes:

[1]Federal USFWS status definitions:

- FE Federal Endangered Species: Any species that is in danger of extinction throughout all or a significant portion of its range
- FT Federal Threatened Species: Any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range
- FPE Federal Proposed Endangered: Species that have been proposed by the USFWS for listing as endangered

FSC Federal Species of Concern: species formerly listed as category 2 candidates, species which may be under threat of extinction but for which there is not sufficient biological information to support a proposed rule to list as threatened or endangered.

[2]State status definitions:

SE State Endangered: A native species or subspecies of animal that is in serious danger of becoming extinct throughout all or a significant portion of its range

ST State Threatened: A native species or subspecies that is likely to become an endangered species in the foreseeable future

CSC California species of Special Concern: Species whose state breeding populations are of special concern in that they may face extirpation, but that have not been listed as threatened or endangered

CSC* Included on 1996 preliminary list of revised CDFG Mammals of Special Concern

[3]USFS status definitions:

MIS Management Indicator Species: Species selected for planning emphasis in the Modoc National Forest LRMP. They are monitored during Forest Plan implementation to assess the effects of management activities.

SA Species Association: Species selected for planning emphasis in the Klamath National Forest LRMP. They are monitored during Forest Plan implementation to assess the effects of management activities.

R5 USFS Region 5 sensitive species: Sensitive species are those identified by the Regional Forester where population viability is a concern.

PB Protection Buffer: Species protected under the Northwest Forest Plan. Species managed to maintain viability throughout their range.

SOURCE: Leitner 1997

Table 3.5-4: Special-Status Wildlife Species Presence at and Use of the Proposed Project Area

Species	Fourmile Hill Area	Telephone Flat Area
Birds		
Bald eagle	4	4
Blue grouse	1 FRC	3
Cooper's hawk	1 FRC	2 FR
Golden eagle	1 F	2 F
Great gray owl	4	4
Hairy woodpecker	2 FRC	3
Loggerhead shrike	4	4
Northern goshawk	1 FRC	2 FR
Northern spotted owl	4	2
Osprey	4	1 FR
Pileated woodpecker	2 FRC	4
Sage grouse	4	4
Swainson's hawk	4	4
Bats		
Fringed myotis	2 FRC	2 FC
Long-eared myotis	2 FRC	2 FC
Long-legged myotis	2 FRC	2 F
Pallid bat	4	2 F

Species	Fourmile Hill Area	Telephone Flat Area
Bats cont'd.		
Silver-haired bat	2 FRC	2 FC
Spotted bat	4	4
Townsend's big-eared bat	2 FC	3 FC
Western mastiff bat	3	2 F
Western small-footed myotis	3	2 FC
Other Mammals		
American badger	4	4
American marten	1 FRC	1 F
Mule deer	2 FRC	3
Oregon snowshoe hare	2 FRC	4
Pacific fisher	3	4
Pronghorn	4	4

Legend:

1 = confirmed present
2 = suitable habitat/may be present
3 = marginal habitat
4 = no suitable habitat/unlikely to be present

F = foraging/hunting habitat
R = reproductive habitat
C = cover (resting/roosting habitat)

[1]Designations reflect a conservative estimate, as a species may not utilize the entire area for a specific use.
[2]Includes proposed substation site.

SOURCE: MHA 1999 and Leitner 1997, BLM et al. 1995, BLM et al. 1999

On-going surveys and monitoring efforts are currently being conducted by CPN at the proposed well pad sites for several special status species, described below. CPN is also monitoring to ensure that preferred bat roosting habitat (large snags, rock piles, and caves, etc.) in the area is not affected by current operations (see POO). The status of the many potential bat species in the project area is outlined in the Fourmile Hill and Telephone Flat survey and environmental documents. The status of the other monitored species is briefly discussed below.

Northern Goshawks are residents of the Medicine Lake Highlands. Widespread sightings suggest that this species forages in a variety of forested habitats throughout this region. The USFS has identified two nest sites for the northern goshawk in the vicinity of the proposed Fourmile Hill well site area. Both nest sites are located more than 0.5 miles from the nearest project facilities. Suitable foraging habitat for the northern goshawk is present throughout the Fourmile Hill well site.

As part of the current POO, CPN is surveying the Telephone Flat pad sites and surrounding areas (out to 0.25 miles) to ensure that no new goshawk nests have been constructed. The entire well site area provides suitable foraging habitat for the northern goshawk although selective timber harvest has created a very open forest canopy that is not optimal for this species. Because of the timber harvest regime, there are few forest stands remaining within the well site area that can provide optimal northern goshawk nesting habitat, which includes large trees and high canopy cover. A few red fir stands within the well site area have not been entered for timber harvest and, as a result, support good numbers of large trees and high canopy cover. A number of isolated habitat patches

within the well site area have some of the basic characteristics of optimal northern goshawk nesting habitat (Leitner and Leitner 1997); however, areas with smaller trees and adequate stand density may also be used be goshawks in the area.

Northern Spotted Owls were addressed in the Northwest Forest Plan (USFS and BLM 1994), which was prepared to provide a plan for the protection and enhancement of old growth and late-successional forest ecosystems in Washington, Oregon, and northern California. These types of ecosystems serve as the primary habitats for the northern spotted owl.

Northern spotted owls (NSO's) are primarily associated with conifer forests in Northern California at elevations from sea level to approximately 7,600 feet. They utilize a variety of forest stand structures for nesting, roosting, and foraging behavior. Roosting and foraging habitats are typically interspersed and could vary in stand structure and canopy closure. Within the Fourmile Hill well site area, roosting habitat consists of areas that are too small to map.

The majority of the project vicinity is designated as “Matrix” land allocation by the Northwest Forest Plan; the standards and guidelines in the Plan for this designation that apply are discussed below. Subsequent to publication of the Northwest Forest Plan, the USFS was directed to designate three Managed Late-Successional Areas (MLSA) on the Modoc National Forest. These contiguous MLSA are located directly south of Medicine Lake and the Glass Mountain Geologic Area. The standards and guidelines in the Northwest Forest Plan for MLSAs apply (see Plans and Policies below).

The nearest known northern spotted owl activity center is about 3.5 miles to the west of the Fourmile Hill well site area. This species was not detected in the well site area during field surveys. No suitable nesting or roosting habitat for the northern spotted owl exists within or adjacent to the well site area, and no preferred habitat for this species would be affected by the proposed project in this area (Galea and Oberlag 1996). Although possible foraging habitat is scattered through the well site area, it is unlikely that the northern spotted owl uses the Fourmile Hill area due to the fragmented condition of potential habitat. The Fourmile Hill well sites would not be located in or near any designated Habitat Conservation Areas for the NSO (Thomas et al. 1990).

The USFS has determined that portions of the Telephone Flat well site area are suitable NSO habitat. The Medicine Lake Highlands are at the eastern edge of the range of the NSO, and at the upper limit of the species elevational range (CDFG and USFS database). Three NSO territories have been identified to the south of the Telephone Flat well site area (USFS data). Since 1989 a number of NSO surveys have been conducted within the Medicine Lake basin. Results of these surveys indicate no NSO breeding activity within the Medicine Lake basin area (Villegas 1991; Gutierrez 1993; and Galea 1996).

The entire Telephone Flat well site area is classified as "Matrix" under the NFMP guidelines and is comprised of 420.4 acres of foraging habitat and 104.7 acres of nesting/roosting habitat. NSO's have not been found in the area, and no breeding pairs have been found in the Medicine Lake basin, an approximately 15,400-acre area. There are three NSO activity areas south of the well site area. No NSO presence/absence surveys were required by the USFS for the NSO analysis provided in the Telephone Flat EIS/EIR (Personal communication - James Villegas, District Biologist, Doublehead Ranger District; October 16, 1997; BLM et al. 1995a, BLM et al. 1998).

American Martens require mature coniferous forest with dense canopy as the highest quality habitat for this species. Potential denning habitat can include areas with large snags, abundant large-sized downed wood, or rocky outcrops. The American marten has been observed regularly throughout the Medicine Lake Highlands and is known to use all timber types in this region, including lodgepole pine forest (Villegas 1997, pers. com.). Martens have been observed in the Telephone Flat well site area, although no den sites have been identified. Suitable foraging habitat for American marten is found throughout the Telephone Flat well site area and in all forest types. There are records of the species within the Telephone Flat area both in summer and winter (Galea 1996b).

REGULATORY FRAMEWORK

Federal

Federal law requires that all Federal departments and agencies shall use their authority to conserve endangered and threatened species as defined in the Federal Endangered Species Act (FESA). The Act defines as "endangered" any species that is in danger of extinction throughout all or a significant portion of its range, and as "threatened" any species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Two other special-status categories are recognized under FESA: (1) proposed for listing as threatened or endangered and (2) species of concern. "Proposed" endangered and threatened species are those species for which a proposed regulation has been published in the Federal Register, but not a final rule. "Species of Concern" is the current designation of species formerly identified as "candidate" for listing in the Federal Register.

Section 9 of FESA prohibits the "taking" of listed species. Under Section 7 of FESA, Federal agencies are directed to consult with the USFWS to ensure that no agency actions would jeopardize the continued existence of any listed species or result in the destruction of critical habitat. Although FESA requires formal consultation only for those species currently listed as threatened or endangered, the USFWS recommends that adverse impacts on species proposed for listing and species of concern also be considered because they may become listed during the design and construction phases of a project.

Region 5 of the USFS has identified a number of wildlife species as "sensitive". Many are species associated with late successional or old growth forest habitats and may be affected adversely by human activities that modify such habitats. The USFS has established policies and regulations designed to protect such species and their habitats, thus ensuring the maintenance of viable populations on USFS lands. The Land and Resource Management Plans (LRMPs) for the Modoc and Klamath National Forests set forth special management goals and directives to ensure that viable populations are maintained on USFS lands. The Modoc National Forest has established a list of "Management Indicator Species" (MIS; Table 3.5-3). The Klamath National Forest has identified "Species Associations" (SA; Table 3.5-3) that are special-status species associated with particular habitat types. Species listed under both the MIS and SA designations include wildlife harvested as game, ecological indicator species, and special interest species.

The Bald Eagle Protection Act. The Act provides federal protection to the bald eagle, and through amendments, to the golden eagle. The act prohibits the direct or indirect take of an eagle, eagle part or product, and nest.

Forest Service Sensitive Plant Program. The USFS has established the Forest Service Sensitive Plant Program as a means to maintain viable populations of all native plant species in habitats occurring on USFS lands, develop and implement management practices to ensure that species do not become threatened or endangered because of USFS actions, develop and implement management objectives for populations and habitat of sensitive species, and to assist states in achieving their goals for the conservation of endemic species. The USFS uses the term "sensitive" to refer to plant species occurring on USFS lands that are considered valid candidates for Federal threatened or endangered listing under FESA (Stewart 1994).

National Forest Management Act. The National Forest Management Act (NFMA) is an amendment to the Forest and Rangeland Renewable Resource Planning Act of 1974. The NFMA establishes a process for adopting, amending, and revising an integrated land and resource management plan (LRMP) for each unit in a national Forest System. The LRMPs for the Klamath and Modoc National Forests are discussed below.

Northwest Forest Plan. The Northwest Forest Plan (NWFP), and resulting Record of Decision, provides guidance for protection of late seral stage-associated species. The guidelines for the protection of these species are currently being developed, but those species listed as Category 2, "survey and manage" will be protected as if they are sensitive species (Sanger 1996, pers. com.; USFS and BLM 1994). More information on the NWFP is presented in introduction of this document (Section 1.0).

State

The California Endangered Species Act (CESA) provides protection for endangered and threatened wildlife species as well. For proposed projects that may or would have an adverse effect on state-listed species, a formal consultation process must be initiated with the CDFG.

In addition to requiring consultation regarding potential adverse impacts to endangered and threatened wildlife, the CDFG currently maintains a list of "Species of Special Concern". These animal species are not listed as endangered or threatened by the State of California at present, but there is a concern that, if current trends continue, they may require official listing in the future. By identifying Species of Special Concern, the CDFG draws attention to the need for protective measures that would prevent the need to designate them as endangered or threatened in the future.

California Natural Diversity Data Base. In order to inventory special status species in California, the CDFG has established the California Natural Diversity Data Base (CNDDB), a program that lists the state's natural vegetation communities and "special plants." CNDDB special plants include state and Federally listed, proposed, and candidate species and taxa that the CDFG considers to be rare, very restricted in distribution, declining, or closely associated with a habitat that is declining at an alarming rate in California. Species that are identified as sensitive by other government agencies (e.g., the BLM and USFS) are also considered to be CNDDB special plants.

California Native Plant Society. The California Native Plant Society (CNPS) publishes and regularly updates the *Inventory of Rare and Endangered Vascular Plants of California*, (Skinner and Pavlik 1994) which has become a standard reference on California's rare and endangered plants. The CDFG recognizes that Lists 1A, 1B, and 2 of the *Inventory* contain plants that, in a majority of cases, would qualify for listing, and the CDFG will request their inclusion in environmental documents as necessary. Species classified as lists 3 or 4 are plants that are considered to be of lower sensitivity and do not fall under Federal or state regulatory authority.

Species Recovery Plans

Bald Eagle. A recovery plan for the bald eagle was published in 1986 (USFWS 1986). The primary goal of the recovery plan is to provide secure habitat for bald eagles within the 7-state Pacific recovery area, and to increase population levels in specific geographic areas to the extent that the species can be delisted. The 7 states that comprise the Pacific recovery area include Idaho, Nevada, California, Oregon, Washington, Montana, and Wyoming.

Providing secure habitat for bald eagles involves identifying breeding and non-breeding habitat, arranging for long-term protection of bald eagle habitat, and managing habitat to ensure that its components are maintained and enhanced. Methods to secure bald eagle habitat that are outlined in the bald eagle recovery plan include: the need to assess the suitability of habitat not presently used by bald eagles, the incorporation of eagle habitat guidelines in agency land-use plans, the design and implementation of plans which secure individual nest sites, roosts, and foraging areas, and the need to maintain forested habitat that is presently used by eagles.

Northern Spotted Owl. A conservation strategy was adopted for the NSO in 1990 that was designed to ensure that adequate amounts of northern spotted owls and owl habitat are protected throughout the owl's range (Thomas et al. 1990). The plan also identifies the need for research and monitoring to test the adequacy of the conservation strategy. Additionally, the plan calls for the need to produce and sustain suitable owl habitat in managed forests.

The conservation strategy focuses on protecting large blocks of owl habitat called Habitat Conservation Areas (HCAs). Included in the conservation strategy is the delineation of a network of HCAs throughout the range of the northern spotted owl. In several regions, current habitat conditions and low owl densities do not allow for the delineation of HCAs, and conservation guidelines have been modified appropriately for these regions.

Under the Conservation Strategy, each HCA has its own management plan. Activities within each HCA should be consistent with their primary management prescriptions to assure that owls have a high probability of persistence. In particular, forests in HCAs

should be maintained in superior habitat condition for owls, and younger forests and logged sites should be allowed to mature into superior habitat.

In 1992, the USFWS published a draft recovery plan for the northern spotted owl. In 1994, the Forest Service and the Bureau of Land Management (BLM), published guidelines for managing northern spotted owl habitat on Forest Service, BLM, and other Federally administered lands (USFS 1994). This plan, called the Northwest Forest Plan, is summarized in the introduction (Section 1.0) and later in this section.

Land and Resource Management Plans

The Fourmile Hill well sites area is located in the Goosenest Ranger District of the Klamath National Forest. The Telephone Flat well sites are located in the Doublehead Ranger District of the Modoc National Forest. Project activities within these areas must comply with the Klamath National Forest Land and Resources Management Plan (LRMP) (USFS 1995) and the Modoc National Forest LRMP (USFS 1991). The LRMPs were developed under the guidelines of the Forest and Rangeland Renewable Resource Planning Act of 1974, as amended by the National Forest Management Act of 1976 and the National Environmental Policy Act of 1976.

Klamath and Modoc National Forest Land and Resource Management Plans

The Klamath and Modoc Land and Resource Management Plans (LRMPs) contain forest-wide and focused standards and guidelines according to each resource area. The introduction of this document (Section 1.0) describes both the Klamath and Modoc LRMPs. Every proposed project must comply with USFS direction from the resource management plans.

The project area is located in an area on the extreme eastern edge of the range of the NSO (i.e., outside of designated late-successional reserves and other old growth management areas), on the edge of the "CA Cascade" physiographic province. This area is delineated in the President Plan, which is synonymous with the NWFP. The plan provides standards and guidelines for matrix areas, including providing a supply of coarse woody debris (i.e., dead and decaying logs) and avoiding the fragmentation of old growth stands in areas where few old growth stands remain. The President Plan specifies that three late-successional territories be delineated in the Medicine Lake area. These territories have been delineated by the USFS (Modoc National Forest 1998).

As discussed previously, the NWFP divides the range of the NSO into seven land allocation categories:

- Congressionally Reserved Areas
- Late-Successional Reserves
- Adaptive Management Areas
- Managed Late-Successional Areas
- Matrix
- Administratively Withdrawn Areas
- Riparian Reserves

The several of the proposed well site areas would be located at the eastern edge of the designated range of the northern spotted owl in California, as delineated in the NWFP.

The proposed project facilities would be located on the edge of the "CA Cascade" physiographic province of the NWFP.

The project would not cross or be adjacent to any Riparian Reserves on either the Klamath or Modoc National Forest. The project area is not located within or near a Key Watershed. The project is also not located in or near any Congressionally-Reserved Areas, Late-Successional Reserves, Managed Late-Successional Areas, or Administratively-Withdrawn Areas.

3.6 Climate and Air Quality

REGIONAL SETTING

Air Quality

The proposed project would be located in Siskiyou County within the Northeast Plateau Air Basin (NPAB). The NPAB extends from the Nevada border on the east to the Siskiyou Mountains on the west; from the Oregon border in the north to the southern border of Lassen County; and includes all of Lassen, Siskiyou, and Modoc Counties (Figure 3.6-1). The NPAB encompasses a total area of 14,920 square miles, and is the fourth largest air basin in California (BLM et al. 1998). The NPAB is classified as "attainment[1]" or "unclassified[2]" for all National Ambient Air Quality Standards (NAAQSs). The NPAB is designated as "attainment" for the California Ambient Air Quality Standards (CAAQS) for Ozone (O_3), oxides of Nitrogen (NO_x), sulfates, and lead (Pb) but is unclassified with regard to sulfur dioxide (SO_2), carbon monoxide (CO), visibility reducing particles, vinyl chloride (chloroethane), and hydrogen sulfide (H_2S). As is the case with most of California, the NPAB is classified "nonattainment[3]" for particulate matter less than 10 microns (PM_{10}) (CARB 1997b).

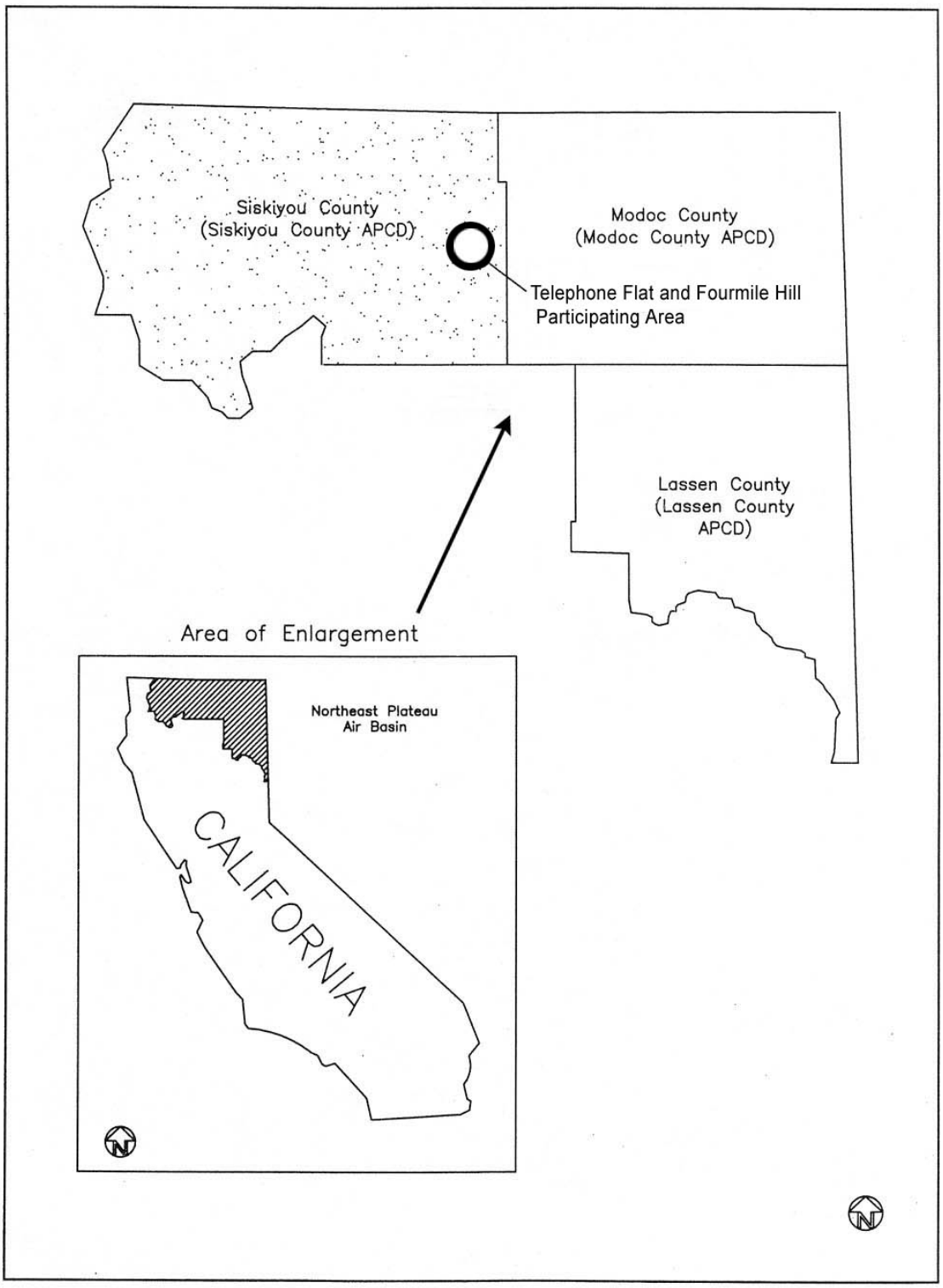
Sources of PM_{10} in the Siskiyou County area are both natural and manmade. Natural sources such as wind-blown dust, pollen, and intermittent forest fires can occasionally contribute to local levels of pollutants in the atmosphere. Forest fires emit air pollutants such as nitrogen oxides, particulates, and unburned organic compounds. Together with natural sources, human activities in rural areas such as dirt road travel and infrequent forest slash and burning can contribute to occasional locally elevated air pollution levels.

The primary source of PM_{10} and the related pollutant, total suspended particulates (TSP), in Siskiyou County is fugitive dust from area sources. The sources of PM_{10} are principally vehicular traffic on unpaved roads and wind erosion of cultivated agricultural land. PM_{10} can also be created indirectly in the atmosphere from chemical reactions that convert gaseous precursors into small particles. These PM_{10} precursors, which are predominantly products of man-made combustion, include NO_x, reactive organic gases (ROGs), and oxides of sulfur (SO_x). Principal existing PM_{10}/TSP sources in the vicinity of the wellfield area are wind erosion from disturbed areas and vehicular traffic on unpaved roads.

The SCAPCD made supplemental measurements of PM_{10} concentrations at the proposed Fourmile Hill power plant site during the summer of 1996, and at the Medicine Lake Guard Station during the summers of 1995 and 1996 (BLM et al. 1998). No exceedances of the CAAQSs or NAAQSs were measured at any of the sites, although one-half of the measured concentrations at the Medicine Lake station exceeded 25 $\mu g/m^3$. 25-$\mu g/$ m3

[1] Attainment-Pollutant concentration does not exceed air quality standards.
[2] Unclassified-No federal standards exist for the pollutant.
[3] Nonattainment-Pollutant concentration exceeds air quality standards.

Figure 3.6-1: Northeast Plateau Air Basin Location and APCD Jurisdictions



SOURCE: California Air Resources Board 1997

does not exceed the CAAQS and NAAQ s standards but is concentrated. This is believed to be largely due to the proximity of the station to several heavily used campgrounds (BLM et al. 1998). Based on 1995 monitoring conducted at the Lava Beds National Monument by CalEPA, Houck (1997a) has estimated the annual average ambient baseline PM_{10} concentrations within the proposed action vicinity at 8.0 $\mu g/m^3$.

Climate and Meteorology

The major topographic feature of the project vicinity is the Medicine Lake Highlands. The Cascade Range contains a north-south chain of isolated volcanic peaks. Considerable climatic variations occur in the region as a result of this topography (BLM et al. 1998).

Weather in northern California is dominated by the position of the Eastern Pacific high-pressure cell normally located off the coast of North America (BLM et. al 1998). Due to the positioning of this cell, an almost unbroken chain of winter storms occurs within the study area and a bulk of the precipitation within the study area occurs during this winter storm period. Weather systems in the region usually result in strong winds and unstable air masses, providing for good dispersion conditions. During fair weather periods, stable air conditions prevail throughout the region.

During the spring, the movement of the Pacific High pressure cell results in a decline of precipitation in vicinity of the proposed action. Spring conditions are rarely warm and dry, due to unstable conditions that result in rain and snow (BLM et.al 1998).

Dry, warm conditions are characteristic of the summer months, although thunderstorms are not uncommon. The transitional period between the summer and winter/spring is generally characterized by cool, clear days and evening temperatures, which drop below freezing.

Precipitation. The average annual precipitation in the vicinity of the proposed project area is approximately 43 inches per year, but ranges from approximately 35 to more than 45 inches per year. Much of the precipitation occurs as snowfall that infiltrates into the subsurface as it melts.

Wind Patterns. Winds in the vicinity of the proposed action are highly variable and are affected by regional wind patterns and topography. Mount Shasta, located approximately 30 miles southwest of the closest proposed action well site, influences weather patterns over the entire region. Gusty winds of high velocity can occur in the region, with storm gusts occasionally exceeding 60 miles per hour (mph). In the Lava Beds National Monument, located approximately 3 miles north of the closest proposed action well site, dry winds from the northwest prevail. The vicinity of the proposed action is subject to severe thunderstorms during the late spring months and the summer months, with storms building up over the cooler Medicine Lake Highlands.

Temperature and Humidity. Recorded temperatures in the project vicinity have ranged from -8°F in the winter to 101°F in the summer. Data was collected in 1995 for the Fourmile Hill Geothermal Development Project for local temperature and humidity. Data from this analysis generally showed an annual variation of temperature, with minimum temperatures occurring in December and January and maximum temperatures occurring

in July and August. Minimum relative humidities occurred in late summer and early fall (August through October) (BLM et.al 1998). These data apply to the two proposed well pad sites (64-27 and 85-33) adjacent to the Fourmile Hill Geothermal Project Area. Measurements were also made and analyzed in the 1999 Telephone Flat Geothermal Development Project EIS/EIR. These data apply to proposed flow test sites 68-8, 31-17, and 87-13. The data collected also showed an annual variation of temperature, with minimum temperatures occurring in the November through January period, and maximum temperatures occurring in July and August. These maximum temperatures are slightly lower than temperatures at the Fourmile Hill Project Site. Minimum average hourly relative humidities occurred in summer and early fall (July through October). The relative humidities are generally higher than at the Fourmile Geothermal Development Project site area.

REGULATORY FRAMEWORK

Federal, state, and local requirements provide for the regulation of air quality in the project vicinity. A discussion of these requirements follows.

Federal

Ambient Air Quality Standards (AAQS).

National AAQS (NAAQS) were established in 1971 for six pollution species with states retaining the option to add other pollutants, require more stringent compliance, or to include different exposure periods. The initial attainment deadline of 1977 was extended to 1987 for NAAQS, and has now been further extended in air quality problem areas like Southern California until the year 2010.

EPA developed standards for chronic ozone exposure (8+ hours per day) and for very small diameter particulate matter (called "$PM_{2.5}$"). New national AAQS were adopted on July 17, 1997. Those national standards currently in effect are shown in Table 3.6-1.

An area that is found to be in violation of NAAQS is called a "nonattainment area." Pollution sources contributing to nonattainment areas are subject to tighter restrictions.

Under the Federal Clean Air Act (CAA), a proposed major source of criteria pollutants is subject to Prevention of Significant Deterioration (PSD) requirements and permitting (CAA Part C Sections 160-169). A major source is defined in 40 CFR 52.21 as a specified source of air pollution (such as an electric power plant or large industrial facility) that emits or has the potential to emit 100 tons per year or more of any criteria pollutant. For non-specified sources (such as geothermal power plants), the major source designation applies to those that emit or have the potential to emit 250 tons per year or more of any criteria pollutant. The proposed project would not be considered a major source subject to PSD review based upon calculated annual emissions.

Table 3.6-1: Federal and California Ambient Air Quality Standards

Ambient Air Quality Standards						
Pollutant	**Averaging Time**	**California Standards [1]**		**Federal Standards [2]**		
		Concentration [3]	**Method [4]**	**Primary [3,5]**	**Secondary [3,6]**	**Method [7]**
Ozone (O_3)	1 Hour	0.09 ppm (180 µg/m³)	Ultraviolet Photometry	0.12 ppm (235 µg/m³)[8]	Same as Primary Standard	Ethylene Chemiluminescence
	8 Hour	—		0.08 ppm (157 µg/m³)		
Respirable Particulate Matter (PM_{10})	Annual Geometric Mean	30 µg/m³	Size Selective Inlet Sampler ARB Method P (8/22/85)	—	Same as Primary Standard	Inertial Separation and Gravimetic Analysis
	24 Hour	50 µg/m³		150 µg/m³		
	Annual Arithmetic Mean	—		50 µg/m³		
Fine Particulate Matter ($PM_{2.5}$)	24 Hour	No Separate State Standard		65 µg/m³	Same as Primary Standard	Inertial Separation and Gravimetic Analysis
	Annual Arithmetic Mean			15 µg/m³		
Carbon Monoxide (CO)	8 Hour	9.0 ppm (10 mg/m³)	Non-dispersive Infrared Photometry (NDIR)	9 ppm (10 mg/m³)	None	Non-dispersive Infrared Photometry (NDIR)
	1 Hour	20 ppm (23 mg/m³)		35 ppm (40 mg/m³)		
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m³)		—		
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	—	Gas Phase Chemiluminescence	0.053 ppm (100 µg/m³)	Same as Primary Standard	Gas Phase Chemiluminescence
	1 Hour	0.25 ppm (470 µg/m³)		—		
Lead	30 days average	1.5 µg/m³	AIHL Method 54 (12/74) Atomic Absorption	—	—	High Volume Sampler and Atomic Absorption
	Calendar Quarter	—		1.5 µg/m³	Same as Primary Standard	
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	—	Fluorescence	0.030 ppm (80 µg/m³)	—	Pararosoaniline
	24 Hour	0.04 ppm (105 µg/m³)		0.14 ppm (365 µg/m³)	—	
	3 Hour	—		—	0.5 ppm (1300 µg/m³)	
	1 Hour	0.25 ppm (655 µg/m³)		—	—	
Visibility Reducing Particles	8 Hour (10 am to 6 pm, PST)	In sufficient amount to produce an extinction coefficient of 0.23 per kilometer—visibility of ten miles or more (0.07—30 miles or more for Lake Tahoe) due to particles when the relative humidity is less than 70 percent. Method: ARB Method V (8/18/89).		**No Federal Standards**		
Sulfates	24 Hour	25 µg/m³	Turbidimetric Barium Sulfate-AIHL Method 61 (2/76)			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m³)	Cadmium Hydroxide STRactan			

1. California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1 and 24 hour), Nitrogen dioxide, suspended particulate matter—PM_{10}, and visibility reducing particles, are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations. In addition,

Section 70200.5 lists vinyl chloride (chloroethene) under "Ambient Air Quality Standards for Hazardous Substances." In 1978, the California Air Resources Board (ARB) adopted the vinyl chloride standard of 0.010 ppm (26 mg/m^3) averaged over a 24-hour period and measured by gas chromatography.

The standard notes that vinyl chloride is a "known human and animal carcinogen" and that "low-level effects are undefined, but are potentially serious. Level is not a threshold level and does not necessarily protect against harm. Level specified is lowest level at which violation can be reliably detected by the method specified. Ambient concentrations at or above the standard constitute an endangerment to the health of the public."

In 1990, the ARB identified vinyl chloride as a Toxic Air Contaminant and determined that there was not sufficient available scientific evidence to support the identification of a threshold exposure level. This action allows the implementation of health-protective control measures at levels below the 0.010-ppm ambient concentration specified in the 1978 standard.

2. National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight-hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when 99 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.

Contact U.S. EPA for further clarification and current federal policies.

3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of mercury (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4. Any equivalent procedure, which can be shown to the satisfaction of the ARB to give equivalent results at or near the level of the air quality standard, may be used. 5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

7. Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.

8. New federal 8-hour ozone and fine particulate matter standards were promulgated by the U.S. EPA on July 18, 1997. The federal 1-hour ozone standard continues to apply in areas that violated the standard. Contact U.S. EPA for further clarification and current federal policies.

SOURCE: California Air Resources Board, 1999

Klamath and Modoc National Forest Land and Resource Management Plans

The Klamath and Modoc Land and Resource Management Plans (LRMPs) contain forest wide and focused standards and guidelines according to each resource area. The introduction of this document (Section 1.0) describes both the Klamath and Modoc LRMPs. Every proposed project must comply with USFS direction from the resource management plans.

State and Local

Ambient Air Quality Standards (AAQS). The standards currently in effect in California are shown in Table 3.6-1. California standards for PM_{10}, which includes $PM_{2.5}$, are more stringent than the federal $PM_{2.5}$ standard.

Siskiyou County Air Pollution Control District. The Siskiyou County Air Pollution Control District (SCAPCD) is responsible for local regulation of air quality, and for implementing state programs and policies to comply with the California Clean Air Act. Applicants proposing new sources of air pollutants are required to obtain an Authority to Construct (ATC) and a Permit to Operate (PTO) from the SCAPCD. Rules for new sources are identified in Regulation VI of the District's Rules and Regulations (SCAPCD 1989).

In order to regulate new air emission sources that would emit or have the potential to emit criteria air pollutants, SCAPCD has adopted New Source Review (NSR) requirements. Two key provisions of NSR requirements are the use of best available control technology (BACT) and the identification of the need for emission offsets. BACT is required for sources emitting more than 250 pounds per day (lb/day) of any pollutant for which there is a national ambient air quality standard, or any precursor of such a pollutant. Emission offsets (or mitigation) may be required for net emission increases (i.e., increases after the application of BACT). The offset of net emission increases would not be required if it is demonstrated through modeling that emissions from a new source would not cause a new violation of any ambient air quality standard.